

Bank Probationary Officer

General Awareness

COMPUTER AWARENESS

A computer is an electronic device that can perform a variety of operations in accordance with a set of instructions called program. It is essentially a data processor. It can store, access and process data millions of times faster than humans can. Computers can do a lot of different tasks such as playing games, weather forecasting, error detection and controlling a flight of space aircraft etc.

Data in computer terminology means raw facts such as name of a person, name of a city, amount of a thing etc.

For eg: Sachin, 1947, A, -160.5 are data.

A processed data is called information. That is, data are aggregated and summarized in various meaningful ways to form information.

Characteristics of Computers

1. *Speed*:- Computers are much faster as compared to human beings. A computer can perform a task in a minute that may take days if performed manually. Usually the speed of computers are expressed in microseconds or nanoseconds.

2. *Accuracy*:- The accuracy of a computer is consistently high. It can perform all the calculations and comparisons accurately provided the hardware does not malfunction.

3. *High storage Capacity*:- Computers can store a large amount of information in very small space. It can store and recall any amount of information because of its secondary storage capability. Every piece of information can be retained as long as desired by the user.

4. *Reliability*:- Computers are immune to tiredness and boredom or fatigue. Thus they are more reliable than human beings.

The Generations of computer

The term 'computer generation' is often used in relation to the hardware of computers. Each phase of computer development is known as a separate generation of computers. Each phase of development is characterised by the type of switching circuits it utilized.

Most computers today use the idea of 'stored program computer', proposed by Dr. John Von Neumann in 1945. The architecture is based on three key concepts;

i. Data and instructions are stored in a single read-write memory.

ii. The memory contents are addressable by locations.

iii. Execution takes place in a sequential fashion, from one instruction to the next unless modified explicitly.

First Generation Computers (1949-55)

The first generation used vacuum tubes, and machine language was used for giving instructions. They used the concept of 'stored program'. They were very large in size and their programming was a difficult task. Some computers of first generation are,

i. **ENIAC**: Electronic Numerical Integrator And Calculator (ENIAC) was the first electronic computer developed. It has a very small memory. Their programs are wired on boards. The addition of two numbers was achieved in 200 microseconds and multiplication in 2000 microseconds.

ii. **EDVAC**: The binary arithmetic was used in the construction of computer called the Electronic Discrete Variable Automatic Computer (EDVAC). The Von Neumann concept of stored program was also applied in EDVAC. With this, the operations became faster since the computer could rapidly access both the program and data.

iii. **EDSAC**: The Electronic Delay Storage Automatic Computer (EDSAC) used mercury delayed lines for storage. It also used Neumann concept of stored program. This allowed easy implementation of program loops. The addition operation was accomplished in 1500 microseconds and multiplication operation in 4000 micro seconds.

iv. UNIVAC-I: The Universal Automatic Computer (UNIVAC) was the first digital computer developed. Initial applications of computers were in science and engineering but with the advent of UNIVAC-I, the commercial applications started.

The first generation computers suffered from some 'big' limitations like slow operating speed, restricted computing capacity, high power consumption, very large space requirement and limited programming capabilities.

Second Generation Computers (1956-65)

The second generation computers emerged with the transistors being the brain of the computer. They used magnetic cores to construct large random access memories. The increased reliability and availability of large memories gave the way for the development of high level languages. With speedy CPUs and the advent of magnetic tape and disk storage, operating systems came into being. Some of the second generation computers with their area of application are given.

Model	Area of application
IBM - 1401	Business
IBM - 1620	Scientific
IBM - 7094	Scientific and Business
CDC - 1604	Scientific
CDC - 3600	Scientific
RCA - 501	Business
UNIVAC - 1108	Scientific and Business

High level languages such as FORTRAN, COBOL, Algol and Snobol etc are developed. Batch operating systems ruled the second generation.

Third Generation Computers (1966- 1975)

The advent of microelectronics technology made it possible to integrate large number of circuit elements into very small surface of silicon known as chips. This technology known as integrated circuits (ICs) is applied in the third generation computers. From small scale integrated (SSI) circuits, technology developed to medium scale integrated (MSI) circuits. The size of main memory reached about 4MB. Magnetic disk technology improved to have a capacity upto 100MBs. The CPUs become powerful with the capacity of carrying out 1 million instructions per second. Some of the mainframe and mini computers developed during

this generation are,

Main frame computers	Mini computers
IBM - 360 series	ICL - 2903
ICL - 1900 series	CDC - 1700
IBM - 370/168 series	PDP - 11/45
ICL - 2900 series	
Honey well model 316 series	
Honeywell 6000 series	
ICL - International Computers Limited	
CDC - Control Data Corporation	
PDP - Personal Data Processor	

Computers also found place in other areas like education, survey, analysis etc. Time shared operating system was introduced in this generation.

Fourth Generation Computers (1976-Present)

Medium scale integrated circuits yielded to Large Scale Integration (LSI) and Very Large Scale Integration (VLSI) circuits. It led to the advent of microprocessor (CPU on a single chip) and marked the beginning of the fourth generation computers. Semi conductor memories replaced magnetic core memories. The cost of computer came down so rapidly. The faster accessing and processing speeds and increased memory capacity helped in development of much more powerful operating systems.

Many of the mainframe CPU features became part of the microprocessor architecture in 90s. In 1995 the most popular CPUs were Pentium, Power PC etc. Also RISC (Reduced Instruction Set Computer) microprocessors are preferred in powerful servers for numeric computing and file services.

The hard disks are also available of the sizes upto 20GB. For larger disks RAID (Redundant Array of Inexpensive Disks) gives storage upto hunderes of GB. CDRoms can store upto 1 GB.

The computer networks are one of the most popular ways of interacting with computer chains of millions of users. The computers are being applied in various areas like simulation, visualization, parallel computing, virtual reality, multimedia etc.

Fifth Generation Computers (coming)

The fifth generation computers using magnetic bubble memories and other recent developments are on the way. They will be based on advances in silicon technology.

The researchers are aiming at developing a machine that can speak simple plain language and able to converse the way the human beings do. For this the concept of Artificial Intelligence is being used.

Types of Computers

The computers have been classified into three categories. (1) Analog computers (2) Digital computers, (3) Hybrid computers

Analog Computers

An analog computer is that it operates on data that is in the form of continuously varying physical quantities such as voltage, current, length, temperature etc. The devices that measure such quantities are analog devices. Analog computers operate by measuring rather than counting. The main advantage of analog computers is that all calculations takes place in parallel and hence these are faster. But their accuracy is poor as compared to digital computers. They are mostly used in Engineering & Scientific applications. An electronic weighing scale is an example of an analog computer.

Digital Computers

A digital computer works on discontinuous data. The word digital implies that the information in the computer is represented by variables that take a limited number of discrete values. They convert the data in to digits (binary digits 0 and 1) and all operations are carried out on these digits at extremely fast rates. It basically knows how to count the digits and add the digits. Computers used for business and scientific applications are digital computers.

Digital computers can be classified into two.

i. purpose wise ii. Size and performance wise

Purpose wise digital computers are further classified into special purpose and general purpose computers.

Special purpose computer is the one that is designed to perform a specific task. The programs to carry out a task are permanently stored in the machine. For the scientific tasks, this type of computer works efficiently but such computers are not versatile.

General purpose computer is the one that can work on different types of programs and thus be used in many applications. The programs are not permanently stored but are input at the time of execution. These computers are very versatile. Size and perform-

ance wise digital computers can be classified into four types, microcomputers, minicomputers, mainframe computers and supercomputers.

Microcomputers: A microcomputer is a computer whose CPU is a microprocessor. It is the smallest category of computer having a microprocessor as its CPU. A microprocessor is a processor whose all main components are on a single integrated circuit chip. Those are normally single processor, single-user systems designed for performing basic operations like educational, small business applications, playing games etc. IBM PCs, Apple Mac, IBM PS/2 are some popular micro computers.

Minicomputers: Minicomputers are more powerful computers than microcomputers in terms of processing power and capabilities. They are relatively-fast but small and inexpensive computer with somewhat limited input/output capabilities. They are mainly multiuser systems and possess greater storage capacity and larger memories as compared to microcomputers. Examples for minicomputers are PDP-11, VAX 7500, MAGNUM etc.

Mainframe computers: Mainframe computers are designed to handle huge volumes of data and information. They can support more than hundred users at same time and are very large and expensive computers having great processing speeds and very large storage capacity as compared to minicomputers. They even possess and work with more than one processor at the same time. So they are multiuser, multiprocessor systems. Very sophisticated operating systems are needed to control and supervise the operation of these mainframe computers. Examples of mainframe computers are ICL 39, CDE 6600, VAX 8842, IBM 3090/600, IBM 4381.

Super Computers: Super computers are the most powerful computers among digital computers. They consists of several processors running together so that they are capable of handling huge amounts of calculations at higher speeds that are beyond human capabilities. Super computers can perform billions of instructions per second. Some of today's supercomputers have the computing capability equal to that of 40,000 microcomputers. These are mainly used in applications like weather forecasting, nuclear science research, aerodynamic modelling, seismology, metrology etc. Examples of super computers are CRAY X-MP/14, CDC - 205, ETA GF-10, FUJITSU VP-400, NEC SX-2, PARAM, ANURAG. PARAM and ANURAG are super computers produced by India.

Hybrid Computers

Hybrid computers utilize the best qualities of both the digital and analog computers. In these computers some calculations takesplace in analog manner and rest of them takesplace in digital manner. Hybrid computers are best used in hospital where analog part is responsible for measurement of patient's heart beat, blood pressure, temperature and other vital signs and then the operation is carried out in digital fashion. They are also used in weather forecasting.

Analog and hybrid computers perform specilized task but the digital comptuers are used almost everywhere in business and scientific applications.

DIGITAL NUMBER SYSTEMS

Many number systems are in use in digital technology. The most common are the decimal, binary, octal and hexadecimal systems. The decimal system is clearly the most familiar because it is a tool that we use everyday.

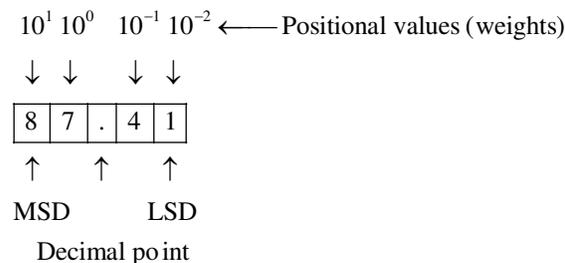
Decimal System

The decimal system consists of 10 numerals or symbols. These 10 symbols are 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9. Using these symbols as digits of a number, we can express any quantity. The decimal system, also called base-10 system, is a positional-value system in which the value of a digit depends on its position.

For eg: Consider a decimal number 532. The digit 5 actually represents 5 hundreds, 3 represents 3 tens and 2 represents 2 units. Then 5 carries the most weight of the three digits, it is referred to as the most significant digit (MSD). Then 2 carries the least weight, it is referred to as the least significant digit (LSD).

The decimal number 87.41 can be written as equal to 8 tens plus 7 units plus 4 tenths plus 1 hundredths. The decimal point is used to separate the integer and fractional parts of the number.

The decimal position value of 87.41 as powers of 10, relative to the decimal point is,



Then

$$87.41 = (8 \times 10^1) + (7 \times 10^0) + (4 \times 10^{-1}) + (1 \times 10^{-2})$$

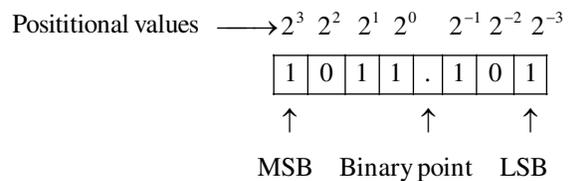
In general, any number is simply the sum of the products of each digit value and its positional value.

Binary System

The decimal number system does not lend itself to convenient implementation in digital systems. For eg: it is very difficult to design an electronic equiptment so that it can work with 10 different voltage levels, each one representing one decimal character, 0 through 9. For this reason, almost every digital system uses binary number system as the basic number system for its operations.

In the binary or base-2 system there are only two symbols or possible digit values, 0 and 1. This base-2 number system can be used to represent any quantity that can be represented in decimal or other number systems. It will take a greater number of binary digits to express a given quantity. All the statements concerning the decimal system are equally applicable to the binary system. It is also a positional-value system, where each binary digit has itsown value or weight expressed as a power of 2.

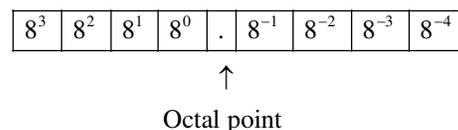
Binary position values of 1011.101 as powers of 2, relative to the binary point is,



In the binary system the term binary digit is often abbreviated to the term, bit. The left most bit having the largest weight is the most significant bit (MSB). The right most bit having the smallest weight is the least significant bit (LSB).

Octal Number System

The octal number system has a base of 8, meaning that it has eight possible digits 0, 1, 2, 3, 4, 5, 6 and 7. Thus, each digit of an octal number can have any value from 0 to 7. The digit positions in an octal number have weights as follows.



Hexa decimal number system

The hexadecimal number system uses base 16. Thus it has 16 possible digit symbols. It uses the digits 0 through 9 plus the letters A, B, C, D, E and F as 16 digit symbols. The hex digits A through F are equivalent to the decimal values 10 through 15.

Relationships between hexadecimal, decimal and binary is shown.

Hexadecimal	Decimal	Binary
0	0	0000
1	1	0001
2	2	0010
3	3	0011
4	4	0100
5	5	0101
6	6	0110
7	7	0111
8	8	1000
9	9	1001
A	10	1011
B	11	1010
C	12	1100
D	13	1101
E	14	1110
F	15	1111

The binary number system is the most important one in digital systems. The decimal system is important because it is universally used to represent quantities outside a digital system. There will be situations where decimal values have to be converted into binary values before they are entered into the digital system. Likewise, there will be situations where the binary values at the outputs of a digital circuit have to be converted to decimal values for presentation to the outside world. Also the octal and hexadecimal number systems are useful to provide an efficient means for representing large binary numbers. For eg: a single hexadecimal digit can be used to represent a group of 4 binary digits.

NUMBER CONVERSIONS

Binary to Decimal Conversion

Any binary number can be converted to its decimal equivalent simply by summing together the weights of the various positions in the binary number which contain a 1.

Eg. 1. Convert 11011_2 to decimal

$$1 \ 1 \ 0 \ 1 \ 1$$

$$2^4 + 2^3 + 0 + 2^1 + 2^0 = 16 + 8 + 2 + 1$$

$$= 27_{10}$$

The subscript is used to represent the corresponding base of the number.

Eg:2. Convert 1101.11_2 to decimal

$$1 \ 1 \ 0 \ 1 \ . \ 1 \ 1$$

$$2^3 + 2^2 + 0 + 2^0 + 2^{-1} + 2^{-2}$$

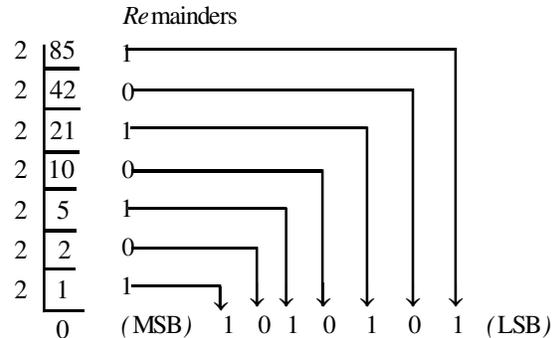
$$= 8 + 4 + 1 + .5 + .25$$

$$= 13.75_{10}$$

Decimal to Binary Conversion

Decimal to binary conversion uses the division-remainder method. In this method the decimal number is repeatedly divided by 2 and writing down the remainder after each division until a quotient of 0 is obtained. The binary result is obtained by writing the first remainder as the LSB and the last remainder as the MSB.

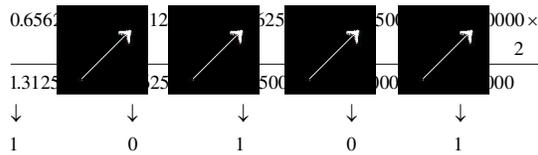
Eg: 1. Convert 85_{10} to binary



$$\therefore 85_{10} = 1010101_2$$

Eg: 2 Convert 0.65625_{10} to binary.

In the case of fractional decimal to binary conversion, the number is first multiplied by 2. Then the integer part of the result is taken as the MSB of the fractional binary number and the fractional part of the result is multiplied by 2. Again the integer part is taken as the right digit of the MSB. The above process is repeated until either the result of multiplication becomes zero or the significant bits of the resultant is obtained.



Thus,

$$0.65625_{10} = 0.10101_2$$

Eg: 3. Convert 10.625_{10} to binary
integer part:

$$\begin{array}{r|l} 2 & 10 \\ \hline & 5 \\ \hline & 2 \\ \hline & 1 \\ \hline & 0 \end{array}$$

$$10_{10} = 1010_2$$

fractional part :

$$\begin{array}{r|l} 0.625 \times & 0.250 \times & 0.500 \times \\ \hline & 2 & 2 \\ \hline 1.250 & 0.500 & 1.000 \\ \hline \downarrow & \downarrow & \downarrow \\ 1 & 0 & 1 \end{array}$$

$$0.625_{10} = 0.101_2$$

Thus, $10.625_{10} = 1010.101_2$

Decimal to Octal conversion

A decimal integer can be converted to octal by using the same division-remainder method with a division factor of 8.

Eg: 1. Convert 428_{10} to octal.

$$\begin{array}{r|l} 8 & 428 \\ \hline & 53 & 4 \\ \hline & 6 & 5 \\ \hline & 0 & 6 \end{array}$$

$$428_{10} = 654_8$$

Eg: 2. Convert $.59_{10}$ to octal

$$\begin{array}{r|l} 0.59 \times & 0.72 \times & 0.76 \times \\ \hline & 8 & 8 \\ \hline 4.72 & 5.76 & 6.08 \\ \hline \downarrow & \downarrow & \downarrow \\ 4 & 5 & 6 \end{array}$$

$$0.59_{10} = 0.456_8$$

Octal to decimal conversion

Eg: 1 Convert 372_8 to decimal

$$\begin{aligned} & 3 \times 8^2 + 7 \times 8^1 + 2 \times 8^0 \\ & = 3 \times 64 + 7 \times 8 + 2 = 250_{10} \end{aligned}$$

$$372_8 = 250_{10}$$

Eg: 2. Convert 0.54_8 to decimal

$$\begin{aligned} & 5 \times 8^{-1} + 4 \times 8^{-2} = 5 \times \frac{1}{8} + 4 \times \frac{1}{64} \\ & = 0.625 + 0.0625 \\ & = 0.6875 \end{aligned}$$

$$0.54_8 = 0.6875_{10}$$

Octal to Binary conversion

In this case the octal number is first converted into decimal and this decimal in turn is converted into binary.

Eg: Convert 472_8 to binary

472_8 to decimal:

$$\begin{aligned} & 472_8 = 4 \times 8^2 + 7 \times 8^1 + 2 \times 8^0 \\ & = 256 + 56 + 2 = 314_{10} \end{aligned}$$

314_{10} to binary:

$$\begin{array}{r|l} 2 & 314 \\ \hline & 157 & 0 \\ \hline & 78 & 1 \\ \hline & 39 & 0 \\ \hline & 19 & 1 \\ \hline & 9 & 1 \\ \hline & 4 & 1 \\ \hline & 2 & 0 \\ \hline & 1 & 0 \\ \hline & 0 & 1 \end{array}$$

Thus, $472_8 = 100111010_2$

Binary to Octal conversion

The binary number is first converted to decimal and this decimal return is converted to binary.

Eg: Convert 100011001_2 to Octal.

100011001_2 to decimal :

$$\begin{aligned} &1 \times 2^8 + 1 \times 2^4 + 1 \times 2^3 + 1 \times 2^0 \\ &= 256 + 16 + 8 + 1 \\ &= 281_{10} \end{aligned}$$

281_{10} to Octal :

$$\begin{array}{r|l} 8 & 281 \\ & \underline{224} & 57 \\ 8 & & \underline{71} & 7 \\ 8 & & & \underline{14} & 2 \\ & & & & \underline{0} & 4 \end{array}$$

Thus

$$100011001_2 = 431_8$$

Shortcut method - Octal and Binary

The primary advantage of the octal number system is the ease with which conversion can be made between binary and octal numbers. The conversion from octal to binary is performed by converting each octal digit to its 3-bit binary equivalent.

Eg: Convert 472_8 to binary

$$\begin{array}{ccc} 4 & 7 & 2 \\ \downarrow & \downarrow & \downarrow \\ 100 & 111 & 010 \end{array}$$

Thus, $472_8 = 100111010_2$

For binary to octal conversion, the bits of the binary number are grouped in to groups of 3-bits starting from the bits to the left of binary point and starting at the MSB for the bits to the right of binary point. Then each group is converted to its octal equivalent.

Eg: Convert 100111010_2 to octal

$$\begin{array}{ccc} 100 & 111 & 010 \\ \downarrow & \downarrow & \downarrow \\ 4 & 7 & 2 \end{array}$$

Thus, $100111010_2 = 472_8$

Decimal to Hex Conversion

Decimal to hex conversion can be performed by

using the division-remainder method with a division factor of 16. Any remainder which is greater than 9 is converted to its hex representation.

Eg: 1. Convert 423_{10} to hex

$$\begin{array}{r|l} 16 & 423 \\ & \underline{336} & 87 \\ 16 & & \underline{26} & 10 \\ 16 & & & \underline{10} & 10 \\ & & & & \underline{0} & 0 \end{array}$$

7
10
1
A
7

Thus, $423_{10} = 1A7_{16}$

Eg: 2. Convert 0.76_{10} to hex.

$0.76 \times$	$0.16 \times$	$0.56 \times$	$0.96 \times$
<u>16</u>	<u>16</u>	<u>16</u>	<u>16</u>
12.16	2.56	8.96	15.36
↓	↓	↓	↓
C	2	8	F

Thus,

$$0.76_{10} = .C28F_{16}$$

Hex to decimal conversion

Eg: 1. convert $2AF_{16}$ to decimal

$$\begin{aligned} &2 \times 16^2 + 10 \times 16^1 + 15 \times 16^0 \\ &= 2 \times 256 + 160 + 15 \\ &= 687_{10} \end{aligned}$$

$$2AF_{16} = 687_{10}$$

Eg: 2. Convert $2B.C4_{16}$ to decimal

$$\begin{aligned} &2 \times 16^1 + 11 \times 16^0 + 12 \times 16^{-1} + 4 \times 16^{-2} \\ &= 32 + 11 + 0.75 + 0.0156 \\ &= 43.7656_{10} \end{aligned}$$

$$2B.C4_{16} = 43.7656_{10}$$

Hex to binary Conversion

The hex number is first converted into decimal and this decimal return is converted into binary.

Eg : Convert $F2_{16}$ to binary

$F2_{16}$ to decimal:

$$15 \times 16^1 + 2 \times 16^0 = 240 + 2 = 242_{10}$$

242_{10} to binary:

$$\begin{array}{r|l}
 2 & 242 \\
 \hline
 2 & 121 \quad 0 \\
 \hline
 2 & 60 \quad 1 \\
 \hline
 2 & 30 \quad 0 \\
 \hline
 2 & 15 \quad 0 \\
 \hline
 2 & 7 \quad 1 \\
 \hline
 2 & 3 \quad 1 \\
 \hline
 2 & 1 \quad 1 \\
 \hline
 & 0 \quad 1
 \end{array}$$

Thus, $F2_{16} = 11110010_2$

Binary to hex conversion

The binary number is first converted to decimal and the decimal number in turn is converted to hex.

Eg: Convert 11010011_2 to hex.

11010011_2 to decimal

$$1 \times 2^7 + 1 \times 2^6 + 0 \times 2^5 + 1 \times 2^4 + 0 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 1 \times 2^0$$

$$= 128 + 64 + 16 + 2 + 1$$

$$= 211_{10}$$

211_{10} to hex:

$$\begin{array}{r|l}
 16 & 211 \\
 \hline
 16 & 13 \quad 3 \\
 \hline
 & 0 \quad 13
 \end{array}$$

Thus,

$$11010011_2 = D3_{16}$$

Shortcut method - hex and binary

Like the octal number system, the hexa decimal number system is used primarily as a short hand method for representing binary numbers. The method is almost similar to the case of octal number but here each hex digit is converted to its 4-bit equivalent.

Eg: Convert $9F2.A6_{16}$ to binary

$$\begin{array}{cccccc}
 9 & F & 2 & . & A & 6 \\
 \downarrow & \downarrow & \downarrow & & \downarrow & \downarrow \\
 1001 & 1111 & 0010 & . & 1010 & 0110
 \end{array}$$

$$9F2.A6_{16} = 100111110010.10100110_2$$

For binary to hex conversion, the bits of the binary number are grouped into groups of 4 bits, starting at the LSB, for the bits to the left of binary point and starting at the MSB, for the bits to the right of binary point. Then each group is converted to its hexadecimal equivalent.

Eg: Convert 1110100110.11001_2 to hex

$$\begin{array}{cccccc}
 0011 & 1010 & 0110 & . & 1100 & 1000 \\
 \downarrow & \downarrow & \downarrow & & \downarrow & \downarrow \\
 3 & A & 6 & . & C & 8
 \end{array}$$

$$1110100110.11001_2 = 3A6.c8_{16}$$

In the case of short cut conversion method dealing hex and octal, the uncompleted groups can be filled by adding extra zeros. For the group to the left of binary point the zeros are added as MSB and for the group to the right of binary point the zeros are added as LSB.

When converting from octal to hex or viceversa, first convert to binary, then convert into the desired number system.

COMPUTER CODES

Numeric data is not the only form of data that is to be handled by a computer. We often require to process alpha numeric data also. An alpha numeric data is a string of symbols where a symbol may be one of the letters A, B, C,, Z or one of the letters a, b, c, z or one of the digits 0, 1, 2, 3,, 9 or a special character, such as +, -, *, /, ., (,) = etc.

When numbers, letters or words are represented by a special group of symbols, they are said to be encoded and the group of symbols is called a code. However, binary coding schemes are used to represent any data in the computer memory. In binary coding, every symbol that appears in the data is represented by a group of bits. The group of bits used to represent a symbol is called a byte.

Digital systems all use some form a binary numbers for their internal operation, but the external world is decimal in nature. This means that conversions between the decimal and binary systems are being performed often. Since the conversion between decimal and binary becomes complicated for large numbers, a means of encoding decimal numbers that combines some features of both the decimal and binary systems are used.

2's complement form:

The 2's complement of a binary number is formed by taking the 1's complement of the number and adding 1 to the least significant bit position. The process for finding the 2's complement of a number is given.

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

Representing Signed Numbers using 2's compliment

The 2's complement system for representing signed numbers is

- i. If the number is positive, the magnitude is represented in its true binary form, and a sign bit of 0 is placed in front of MSB.
- ii. If the number is negative, the magnitude is represented in its 2's complement form, and a sign bit of 1 is placed in front of MSB.

$$\begin{array}{c}
 \boxed{0\ 1\ 0\ 1\ 1\ 0\ 1} = +45_{10} \\
 \uparrow \\
 \text{Sign bit} \quad \text{True binary}
 \end{array}$$

$$\begin{array}{c}
 \boxed{1\ 0\ 1\ 0\ 0\ 1\ 1} = -45_{10} \\
 \uparrow \\
 \text{Sign bit} \quad \text{2's complement}
 \end{array}$$

The 2's complement system used, allows to perform the operation of subtraction by actually performing addition.

BOOLEAN ALGEBRA AND LOGIC GATES

Digital or logic circuits operate in the binary mode where each input and output voltage is either a 0 or 1; the 0 and 1 designations represent predefined voltage ranges. This characteristic of logic circuits allows to use Boolean Algebra as a tool for the analysis and design of digital systems.

Boolean algebra differs in a major way from ordinary algebra in that Boolean constants and variables are allowed to have only two possible values. A Boolean variable is a quantity, that may, at different times, be equal to either 0 or 1.

Boolean algebra is used to express the effects that various digital circuits have on logic inputs, and to manipulate the logic variables for the purpose of determining the best method for performing a given circuit function. In Boolean algebra there are only three basic operations : OR, AND and NOT. These basic operations are called logic operations.

Digital circuits can be constructed from diodes, transistors and resistors connected in such a way that the circuit output is the results of a basic operation performed on the inputs and such circuits are called logic gates.

Truth Table

A truthtable is a means for describing how a logic circuit's output depends on the logic levels present at the circuits inputs. The table lists all possible combinations of logic levels present at inputs along with the corresponding output level. There are 4 table entries for the two-input truth table and 8 entries for a three-input truth table. The number of input combinations will equal 2^N for an N-input truth table.

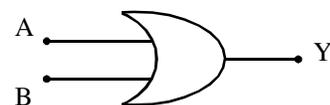
OR operation

The OR operation is defined as : the output of an OR gate is 1 if and only if one or more inputs are 1 and output is 0 if and only if all inpouts are 0. The logical equation for 2 input OR operation is given by

$$Y = A + B$$

where A and B represent two independent logic variables and Y represent the result of OR operation. and '+' represents the OR operation.

OR gate: An OR gate is a circuit that has two or more inputs and whose output is equal to the OR sum of the inputs. The logic symbol and the truth table for a 2 input OR gate is given.



A	B	Output $Y = A + B$
0	0	0
0	1	1
1	0	1
1	1	1

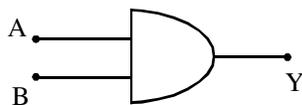
AND Operation

The AND operation is defined as: the output of AND gate is 1 if and only if all the inputs are 1 and output is 0 if and only if any of the input is 0. The logical equation or boolean equation for 2 input AND operation is given by

$$Y = A \cdot B$$

Where A and B are independent Boolean variables, \cdot represents the AND operation and Y represents the results of AND operation.

AND gate: An AND gate is a circuit that has two or more inputs and whose output is equal to the AND product of the logic inputs. The logic symbol and the truth table for a 2 input AND gate is given.



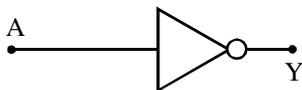
A	B	$Y = A \cdot B$
0	0	0
0	1	0
1	0	0
1	1	1

NOT operation

The NOT operation requires only one logic input and the operation is defined as: the outputs of NOT gate is 1 if and only if its input is 0 and output is zero if and only if its input is 1. The boolean equation for NOT operation is given by $Y = \bar{A}$

The NOT operation is also referred to as inversion or complementation.

NOT gate (inverter): The NOT gate is a circuit that has only a single input and its output logic level is always opposite to the logic level of this input. The logic symbol and truth table for the NOT gate is given.



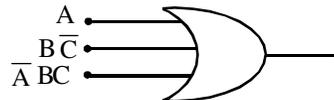
A	$Y = \bar{A}$
0	1
1	0

The presence of a small circle, known as the bubble always denote inversion in digital circuits.

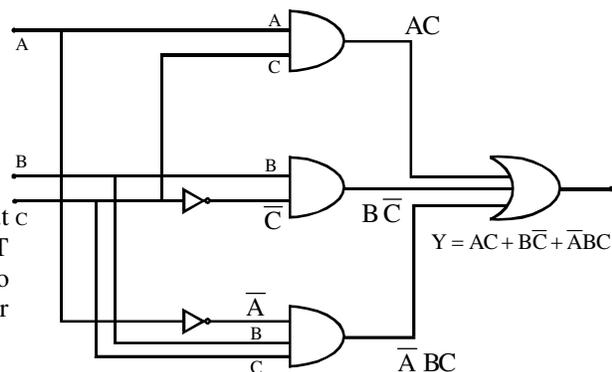
Implementing logic circuits from Boolean expressions

Any logic circuit can be completely described using the Boolean operations defined, because the OR, AND and NOT gates are the basic building blocks of digital systems. Also, if the operation of a circuit is defined by a Boolean expression, the logic circuit diagram can be implemented directly from that expression.

For eg: Consider the boolean equation $Y = AC + B\bar{C} + \bar{A}BC$. This expression contains three terms, AC, $B\bar{C}$, $\bar{A}BC$ which are ORed together. So a three input OR gate is used with these three inputs.



$$Y = AC + B\bar{C} + \bar{A}BC$$



Each OR gate input in turn is an AND product term, which means that an AND gate with appropriate inputs can be used to generate each of these terms. The inverters can be used to produce \bar{A} and \bar{C} terms required in the expression.

Boolean theorems

Boolean theorems are laws that can be used to simplify Boolean expressions and logic circuits that are expressed its operation mathematically using Boolean algebra.

Boolean identities

And Operations

- $A \cdot 1 = A$

2. $A \cdot 0 = 0$

3. $A \cdot A = A$

4. $A \cdot \bar{A} = 0$

OR Operation

5. $A + 0 = A$

6. $A + 1 = 1$

7. $A + A = A$

8. $A + \bar{A} = 1$

NOT Operation

9. $\overline{\bar{A}} = A$

Commutative law

10. $AB = BA$

11. $A + B = B + A$

Associative law

12. $A + (B + C) = (A + B) + C$

13. $A(BC) = (AB)C$

Distributive law

14. $A(B + C) = AB + AC$

15. $A + (BC) = (A + B) \cdot (A + C)$

De Morgan's theorem

16. $\overline{A + B} = \bar{A} \cdot \bar{B}$

17. $\overline{A \cdot B} = \bar{A} + \bar{B}$

Some useful results

18. $A + AB = A$

19. $A \cdot (A + B) = A$

20. $A + \bar{A}B = A + B$

21. $A(\bar{A} + B) = AB$

22. $(A + B)(A + C) = A + BC$

23. $AB + AC = A(B + C)$

De Morgan's theorems

De Morgan's first theorem states that compliment of a sum is same as the product of their complements.

ie, $\overline{A + B} = \bar{A} \cdot \bar{B}$

De Morgan's second theorem states that complement of a product is same as the sum of their complements.

ie, $\overline{A \cdot B} = \bar{A} + \bar{B}$

Eg:1. Simplify the expression $AB + A(B + C) + B(B + C)$ using Boolean algebra.

$$AB + A(B + C) + B(B + C)$$

$$= AB + AB + AC + BB + BC$$

$$= AB + AC + B + BC \quad [\because AB + AB = AB, BB = B]$$

$$= AB + AC + B(1 + C)$$

$$= AB + AC + B \quad [\because 1 + C = 1]$$

$$= B(A + 1) + AC$$

$$= B + AC \quad [\because A + 1 = 1]$$

$$\therefore AB + A(B + C) + B(B + C) = B + AC$$

2. Simplify expression $[A\bar{B}(C + BD) + \bar{A}\bar{B}]C$ using Boolean algebra.

$$(A\bar{B}(C + BD) + \bar{A}\bar{B})C$$

$$= (A\bar{B}C + A\bar{B}BD + \bar{A}\bar{B})C$$

$$= (A\bar{B}C + \bar{A}\bar{B})C \quad [\because \bar{B} \cdot B = 0]$$

$$= A\bar{B}CC + \bar{A}\bar{B}C$$

$$= A\bar{B}C + \bar{A}\bar{B}C \quad [\because C \cdot C = C]$$

$$= \bar{B}C(A + \bar{A})$$

$$= \bar{B}C \quad [\because A + \bar{A} = 1]$$

$$\therefore (A\bar{B}(C + BD) + \bar{A}\bar{B})C = \bar{B}C$$

3. Simplify using DeMorgan's theorem

i. $Y = \overline{A + B\bar{C} + D(E + \bar{F})}$

$$= \overline{A + B\bar{C}} \cdot \overline{D(E + \bar{F})}$$

$$= (A + B\bar{C}) \cdot \overline{D(E + \bar{F})} \quad [\because \overline{\bar{A}} = A]$$

$$= (A + B\bar{C}) \cdot (\bar{D} + \overline{E + \bar{F}})$$

$$= (A + B\bar{C}) (\bar{D} + E + \bar{F}) \quad [\because \overline{\bar{A}} = A]$$

$$\therefore \overline{A + B\bar{C} + D(E + \bar{F})} = (A + B\bar{C}) (\bar{D} + E + \bar{F})$$

ii. $Y = \overline{\bar{A} + B + CD}$

$$= \overline{\bar{A} + B} \cdot \overline{CD}$$

$$= (A + B) \cdot CD$$

$$= (A + B) \cdot CD$$

iii. $Y = \overline{ABC} + \overline{(\overline{D} + E)}$

$$Y = \overline{A} + \overline{B} + \overline{C} + (\overline{\overline{D} \cdot E})$$

$$= \overline{A} + \overline{B} + \overline{C} + D \cdot E$$

$$\therefore \overline{ABC} + \overline{(\overline{D} + E)} = \overline{A} + \overline{B} + \overline{C} + D \cdot E$$

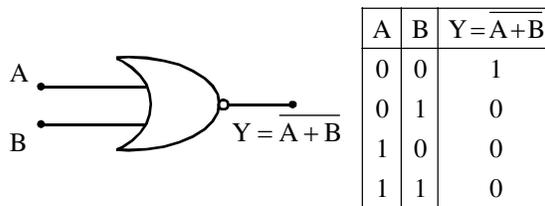
NOR gates and NAND gates

NOR and NAND gates actually combine the basic operations AND, OR and NOT, which make it relatively easy to describe them using the Boolean algebra operations.

NOR gate : NOR gate is combination of OR and NOT gates. The NOR gate operates like an OR gate followed by an inverter. The Boolean expression for NOR gate is given by.

$$Y = \overline{A + B}$$

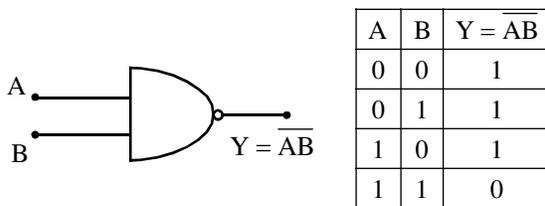
The logic symbol and truth table of NOR gate is given.



NAND gate: NAND gate is a combination of AND and NOT gate. The NAND gate operates like an AND gate followed by an inverter. The Boolean expression for NAND gate is given by,

$$Y = \overline{AB}$$

The logic symbol and truth table NAND gate is given.

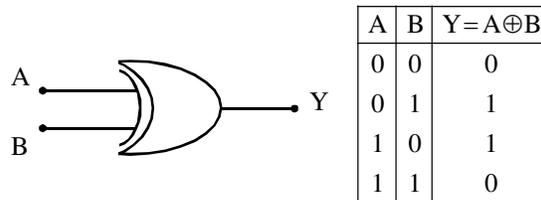


EXCLUSIVE-OR (EX-OR) operation

The EX-OR operation is not a basic operation and can be performed using the basic AND, OR, NAND or NOR gates. The EX-OR operation is defined as: the output of an EXOR gate is 1 if and only if both the inputs are different and output is 0 if and only if both inputs are same. So this EX-OR gate finds application where two digital signals are to be compared. The Boolean equation is given by

$$Y = A\overline{B} + \overline{A}B$$

$$= A \oplus B$$



EXCLUSIVE-NOR (EX-NOR) operation

The EX-NOR operation is defined as: the output of EX-NOR gate is 1 if and only if both the input are same and output is 0 if and only if both the input are different. The Boolean equation for EX-NOR gate is given by

$$Y = \overline{A\overline{B}} + \overline{\overline{A}B}$$

$$= A \ominus B$$

A	B	Y = A · B
0	0	1
0	1	0
1	0	0
1	1	1

Universality of NAND gates and NOR gates

All Boolean expressions consist of various combinations of the basic operations of OR, AND and NOT. It is possible to implement these basic operations and any logic expressions using only NAND gates or using only NOR gates. Due to this characteristics of NAND gate and NOR gate, they are known as universal gates.

MISCELLANEOUS - 1

BINARY NUMBER SYSTEM

NOT gate
This system has a base 2, using only 0 and 1. The electric switch has an analogy with binary system. It is either close i.e. ON, representing 1 or it is OFF representing 0. It is this analogy which is responsible for the construction of powerful digital computers.

Conversion of Decimal Number to Binary Numbers
A popular method to convert decimal numbers to binary numbers is to progressively divide the decimal number by 2, writing down the remainders when taken in the reverse order, will form the binary number.

Example: method to convert decimal numbers to binary numbers by 2: writing down the remainders when taken in the reverse order, will form the binary number.

$11 \div 2 = 5$ with a remainder 1
 $5 \div 2 = 2$ with a remainder 1
 $2 \div 2 = 1$ with a remainder 0
 $1 \div 2 = 0$ with a remainder 1

Now we place the remainder in the reverse order which gives 1011_2 binary number equivalent to the decimal number 11_{10} .

Conversion of Binary Number to Decimal Number
Following four steps can be used to convert a Binary Number to Decimal Number.

- i. Write the binary number.
- ii. Just under the binary number write 1, 2, 4, 8, 16 starting from right to left.
- iii. If a zero appears in a digit position cross out the decimal weight for that position.
- iv. Add the remaining weights to obtain the decimal equivalent.

Example (1) : Conversion of binary number 101_2 to its decimal equivalent.

Step I : 101_2
 Step II : $4 \quad 2 \quad 1$
 Step III : $4 \quad / \quad 1$
 Step IV : $4 + 1 = 5$
 i.e. 5_{10} is decimal equivalent of binary number 101_2 .

Example (2) : Conversion of binary number 10101_2 to its decimal equivalent.

Step II : $16 \quad 8 \quad 4 \quad 2 \quad 1$
 Step III : $16 \quad / \quad 4 \quad / \quad 1$
 Step IV : $16 + 4 + 1 = 21$
 i.e. 21_{10} is decimal equivalent of binary number 10101_2 .

Binary Addition

Rule $0 + 0 = 0$
 $0 + 1 = 1$
 $1 + 0 = 1$
 $1 + 1 = 10$

Example:
 Three NOR gates used as an AND gate
 (1) Add 1010_2 and 101_2

$$\begin{array}{r} 1010 \\ + 101 \\ \hline 1111_2 \end{array}$$

(2) Add 10110_2 and 101_2

$$\begin{array}{r} 10110 \\ + 101 \\ \hline 11011_2 \end{array}$$

NAND gate

Four NOR gates used as a NAND gate.

Universal Property of NAND gates

NAND gates can be used to generate NOT, AND, OR and NOR functions.

NOT gate

4 is written as **** and so on.

If **** is added to ***, what will be the result ?

(1) ••• (2) **** (3) ***** (4) ***** (5) None of these

Which of the following will represent 25% of 36 ?

(1) •••• (2) ***** (3) ***** (4) •••• (5) None of these

If is ***** divided by ****, find the result.

(1) ** (2) •• (3) *• (4) ••• (5) None of these

Which of the following will represent 19 ?

(1) ***** (2) ***** (3) ***** (4) ***** (5) None of these

Which of the following will represent the value of the expression $4 \times 9 \div 3$?

(1) ••• (2) **** (3) ***** (4) *** (5) None of these

$\frac{•}{•} + \frac{••}{••} - \frac{••}{••} = ?$

AND gate

Two NAND gates used as an AND gate

(1) ** (2) ** (3) ** (4) *** (5) None of these

Which of the following will represent 19 ?

(1) ***** (2) ***** (3) ***** (4) ***** (5) None of these

Which of the following will represent the value of the expression $4 \times 9 + 3$?

(1) *** (2) *** (3) ***** (4) *** (5) None of these

$\frac{2}{3} + \frac{3}{4} - \frac{1}{6} = ?$

OR gate Three NOR gates used as an OR gate.

(1) (2) (3) (4) (5) None of these

$\sqrt{25} \times \sqrt{16} = ?$

(1) *** (2) *** (3) *** (4) *** (5) None of these

Find the value of the expression, $10 + 10 + 10 \times 4$

(1) *** (2) ***** (3) ***** (4) ***** (5) None of these

Which of the following represent $\sqrt{625}$?

(1) ***** (2) ***** (3) ***** (4) ***** (5) None of these

NOR gate Four NAND gates used as a NOR gate

COMPUTER ORGANIZATION

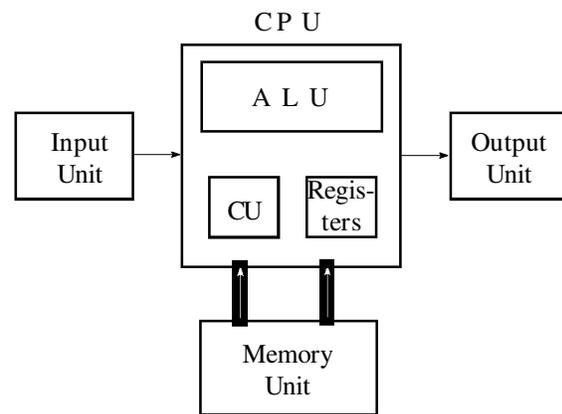
Computer Organization is concerned with the way the hardware components operate and the way they are connected together to form the computer system. The task is to investigate the organizational structure to verify that the computer parts operate as intended. The block diagram of the basic computer organization is shown. It consists of four major parts. The Central Processing Unit (CPU) contains an Arithmetic and Logic Unit (ALU) for manipulating data, a number of registers for storing data, and a Control Unit (CU) for fetching and executing instructions. The input unit is used for passing data and instructions to the computer system. The output unit is used to supply information and results of computations to the outside world. The memory unit contains storage for instructions and data.

Arithmetic Logic Unit (ALU)

The arithmetic logic unit performs the required microoperations for executing the instructions. All calculations and all comparisons are made in the ALU. The data stored in the memory are transferred, as and when needed, to the ALU where processing takes place. No processing is done in the memory unit. ALU is designed to perform the four basic arithmetic operations add, subtract, multiply, divide and logic operations or comparisons such as less than, equal to or greater than.

Central Processing Unit (CPU)

The part of the computer that performs the bulk of data processing operations is called CPU. The three major parts of CPU are ALU, CU and registers. CPU is also responsible for activating and controlling the operations of other units of the computer system.



Control Unit (CU)

By interpreting the program instructions, the control unit is able to maintain order and direct the operations of the entire system. It does not perform any actual processing on the data. It obtains instructions from the program stored in the memory, interprets the instructions, and issues signals that cause other units of the system to execute them.

Memory Unit

The memory unit is an essential component in a computer since it is needed for storing programs and data. The memory unit that communicates directly with the CPU is called the main or primary memory. Devices that provide backup storage are called auxiliary or secondary memory. Only programs and data currently needed by the processor reside in main memory and all other information is stored in auxiliary memory and transferred to main memory when needed.

Main Memory

The main memory is the central storage unit in a computer system. It is a relatively fast memory used to store programs and data during the computer operation. Only programs and data currently needed by the processor reside in main memory. The principal technology used for the main memory is based on semiconductor integrated circuits. The main memory is divided into two types.

- i. Random Access Memory (RAM)
- ii. Read Only Memory (ROM)

RAM

RAM means Random Access Memory. In RAM it is possible to select and use any random location of this memory to store and retrieve data. It is also known as read/write memory because contents can be read from as well as written into it. It is used for storing programs and data that are subject to change. Since RAM is volatile, its contents are destroyed when power is turned off. Integrated circuit RAM chips are available in two possible operating modes. Static RAM and Dynamic RAM. The dynamic RAM offers reduced power consumption and larger storage capacity in a single memory chip. The static RAM has shorter read and write cycles.

Registers

A register is a storage unit of data. It is required in the CPU for storing the instruction-code after it is read from memory. There are eight processor registers.

1. Data Register (DR): The data register holds the data read from the memory.
2. Address Register (AR): The AR holds the address of the memory location whose content is to be accessed for processor operation.
3. Accumulator (AC): The accumulator register is a

general purpose processing register, in which the result of an arithmetic or logic operation is formed.

4. Instruction Register (IR): The instruction register is for storing the instructions read from the memory.
5. Temporary Register (TR): TR is used for holding temporary data during the processing.
6. Program Counter (PC): The program Counter stores the address of the next instruction to be fetched from the memory.
7. Input Register (INPR): It stores the input character received from an input device.
8. Output Register (OOURT): The OOURT holds a character for an output device.

Sequential access memory

A sequential access memory is one in which the access time depends upon the location of the stored data. The accessing of the desired location is preceded by sequencing through other locations, so that access time varies according to the location. Examples for sequential access memory device is magnetic tape.

Direct access memory

A direct access memory is one in which any location in the memory may be selected at random, access to the information stored is direct and approximately equal access time is required for each location. Example for such devices are magnetic disk, floppy disk, optical disk etc.

ROM

ROM means Read Only Memory. In ROM, contents are permanently stored. The information from the memory can only be read and it is not possible to write fresh information into it. Since ROM is non volatile, its contents are not destroyed when the power is turned off.

A variation from ROM is PROM, EPROM and EEPROM. PROM is the Programmable Read Only Memory. It can be programmed once. ie, the PROM becomes a ROM once it has been programmed. EPROM is Erasable Programmable Read Only Memory. It is possible to erase information stored in an EPROM and can be reprogrammed to store new information. When an EPROM is in use, information can only be read and the information remains on the chip until it is erased. The EPROM is erased by exposing the chip to ultraviolet light.

EEPROM is Electrically Erasable ROM. This type of ROM can be programmed and erased by electrical signals. Its main application is as a backup to RAM.

Auxiliary Memory

Devices that provide backup storage are called auxiliary memory. They are used for storing system programs, large data files and other backup information. They are slower than primary memory. Auxiliary memory holds the information that are not presently used by the CPU. The most common auxiliary memory devices are magnetic disks, magnetic tapes and optical disks. Auxiliary memory is divided into two types according to the method of accessing the stored information. They are sequential or serial access and direct or Random Access Memory.

Secondary Storage Devices

The storage capacity of a high speed main memory of a computer system is limited. The storage capacity of primary storage is not sufficient to store large volume of data handled by most data processing centres. So low cost large capacity secondary storage devices are used for the backup of primary memory. According to the storage technology used, there are different types of secondary storage devices.

Magnetic Tape

Magnetic tape is one of the most popular storage medium for large data that are sequentially accessed and processed. The tape is a plastic ribbon usually for 1/2 inch wide and is coated on one side with an iron oxide material which can be magnetized. It is similar to the audio tape with higher quality and durability. It can be erased and reused indefinitely.

Information is recorded on the tape in the form of tiny invisible magnetized and non magnetized spots (representing 1's and 0's) on the iron oxide side of the tape. The tape is divided into vertical columns called frames and horizontal rows called channels or tracks. One character is recorded per frame using one of the computer code representations. There must be a magnetic tape drive to read from the magnetic tape. Magnetic tape drive is a machine that can either read data from a tape in to the CPU or it can write the information being produced by the computer on to a tape. Advantages of magnetic tape storages are low cost, higher data transfer rate etc. and disadvantages of tape storages are lack of random access environmental problems etc.

Magnetic Disk

A magnetic disk is a thin, circular metal plate coated on both sides with a magnetic material. A disk pack consists of a number of these disks, three or more mounted about half-an-inch apart from each other, on a central shaft which rotates at high speed. Thus all the disks of the pack move simultaneously in the same direction and at equal speed.

In a disk pack, information is stored on both the surfaces of each disk plate except the upper surface of the top plate and the lower surface of the bottom plate, which are not used. Each disk consists of a number of invisible concentric circles called tracks. A set of corresponding tracks in all the surfaces is called a cylinder. Each track is subdivided into sectors. Information is recorded on the tracks of a disk surface in the form of invisible tiny magnetic spots. The presence of magnetic spot represents binary 1 and absence, binary 0. The data stored on a disk remains indefinitely until they are erased and reused at a future time.

Floppy Disk

The popular direct access secondary storage medium for micro and mini computer systems is the floppy disk. The floppy disk is made of flexible plastic which is coated with magnetic oxide. The flexible disk is enclosed within a square plastic or cardboard jacket. Unlike the hard disk drives, the read/write head of a floppy disk unit make direct contact with the disk surface during the process of reading or writing.

Floppy disks are typically 3½, 5¼ or 8 inches in diameter. The capacity of diskettes varies depending on their size. They come in either single or double density versions and recorded on one or both surfaces of a diskette. There are different versions,

- i. Single Sided Single Density (SSSD)
- ii. Single Sided Double Density (SSDD)
- iii. Double Sided Single Density (DSSD)
- iv. Double Sided Double Density (DSDD)

Floppy disks are inexpensive and can be used as both on-line (connected to computer and under the control of CPU) storage and as off-line (not connected to computer system) storage.

Winchester or Hard disk

It is a metallic disk pack in which units are permanently housed in sealed, contamination free containers. The disks are coated with a special lubricant which reduces the friction. The container is usually

not removed from the disk drive. The number of tracks are increased and thus the storage density per track is increased. Compared to the floppy disk hard disk has large storage capacity, high speed and expensive

All computers use this multiplatter disks for their main data storage. Data are recorded on tracks and each surface have its own read/write head. This head floats over a cushion of air generated by the spinning platters.

Optical Disks

An optical disk storage system consists of a rotating disk which is coated with a thin metal or other material that is highly reflective. Data recording is done by focussing high power laser beam on the surface of the spinning disk. The laser beam is turned on and off at a varying rate because of which tiny pits are burnt into the metal coating on the disk along its tracks. In order to read the data, a less-powerful beam is focussed on the disk surface and weakly reflected by the pits, producing patterns of on-off reflections that can be converted into electronic signals. Once the data is recorded the storage unit cannot be re-recorded. So this type is known as Compact Disk Read Only Memory (CDROM). Information on a CDROM is written as a single continuous spiral, unlike magnetic disks with their discrete cylinders and tracks.

Magnetic Bubble Memory (MBM)

It is a non electro mechanical secondary storage device. It is an electronic secondary storage made with solid-state electronic chips and have no moving parts. They are formed by applying magnetic fields to thin sheets of certain magnetic materials. The magnetic field strengthen and weaken some regions in the material. The strengthened regions resemble positive charge. The presence or absence of these charged bubbles corresponds to a 1 or 0 in the binary code.

Magnetic bubble memories are used as main memory in several microprocessor applications. These chips are nonvolatile.

Charge Coupled Device (CCD)

It is also a completely electronic memory, fabricated on semiconductor chips. It uses electrons within a metal oxide semiconductor (MOS) crystal to store data. CCD is faster than MBM, very compact and inexpensive. This CCD is a volatile secondary storage medium.

Processor

The instructions given to the computer are interpreted and carried out by the processing unit. The set of instruction codes which are used to instruct the processor to perform operations, is known as the instruction set of that processor. A sequence of particular instructions to perform an operation is known as a software or a program.

The basic computer has eight registers, a memory unit, an ALU and a control unit. The memory unit stores the instructions and data, on which these instructions operate. The control unit interpret the instructions from memory and generate corresponding control signals for other units, to perform the specified operation. The ALU performs arithmetic and logic operations on the data from memory, according to the control signals from control unit. The registers stores the data temporarily.

Common Bus System

There must be paths for transferring information from one register to another and between memory and registers. If there is data path for all possible transfer, there will be excessive wires. The wired path which provides transfer of data is known as bus. A more efficient scheme for transferring information in a system with many units is to use a common system bus. The binary information is transferred through the bus under the control of a control signal.

The control signal determines which units take part in the data transfer.

Buses are classified into three types:

1. Data bus: - A bus which carries a word to or from the memory is known as data bus.
2. Address Bus : An address bus carries the address value which indicates a particular memory location.
3. Control Bus : The control bus carries the control signals between the different units of a computer.

The data bus, address bus and control bus are together known as system bus.

Instruction cycle

The basic function of a computer is program execution. The CPU does the actual work by executing the instructions specified in the program. The program execution mainly consists of three micro operations,

fetch cycle, decode cycle and execution cycle. The fetch cycle fetches the instruction stored in the memory. The decode cycle decodes or interprets the instruction fetched. It also fetches the data from memory, if the instruction specifies. The execution cycle executes the instruction and stores the result. These three cycles together known as instruction cycle or fetch-decode-execute cycle.

Input/Output Devices

Input/Output (I/O) devices are means of communication between the computer and external environment. Regardless of the nature of the I/O devices, special processors called I/O interfaces or I/O processors are required to convert the input data to the internal codes used by the computer and to user readable form while supplying the output.

Input Devices:

Input devices are used to enter data into the primary storage. Some of the input devices are general purpose, that is, they may be used by any computer. Special purpose devices are Magnetic Ink Character Reader (MICR), Optical Mark Reader (OMR), Optical Character Reader (OCR) and Barcode Reader.

Punched Card Reader

It uses a card having punched holes representing different characters. A punched card reader reads the information punched in to the card, converting the presence or absence of a hole into an electrical signal representing a binary 0 or 1. Thus the holes in a card are converted into coded electrical pulses that the CPU can accept.

Key Board

The most commonly used input device is the keyboard. Key board enters data directly into the primary memory. It contains key for each character. When a key is pressed, corresponding electric pulses will be generated and this pulse code is converted into binary codes and stored in primary memory.

Mouse

Mouse is a pointing device with a roller on its base. When the mouse rolls on a flat surface, the cursor on the screen also moves in the direction of the mouse movement. The movement of the mouse actually causes a roller to move and this relative motion is then converted into digital values and used as the input data. A mouse has two or three buttons to control the input data.

Joystick

A joystick is a stick set in two crossed grooves and can be moved left or right, forward or backward. The movements of the stick are sensed and are translated into binary instructions with the help of electrical contacts in its base. It is used as a graphical input device.

Light pen

It is also a pointing device. It consists of a photocell mounted in a pen shaped tube. When the pen is brought in front of a picture element on the screen, it senses light coming from the point on the screen. This light causes the photo cell to respond by generating a pulse. The processor identifies the graphical point the light pen is pointing to.

Magnetic Ink Character Reader (MICR)

MICR is used for reading human readable characters on documents such as cheques, that are printed using a special magnetic ink. The characters in a special font are scanned and converted into their representations.

Optical Mark Reader (OMR)

OMR is used for reading the data from a specially marked data sheet. They are capable of recognising a predefined type of mark made by pencil or pen. The marking is scanned by passing light through the paper.

Optical Character Reader (OCR)

OCR is a device capable of detecting alphabetic and numeric characters printed on a paper. These characters may be either typewritten or hand written. The character pattern is detected and the corresponding electrical signal is generated.

Bar Code Reader

Data coded in the form of light and dark lines or bars are known as bar codes. A bar code reader is used for reading these data. The reading is performed by a laser beam scanner which is linked to a computer.

Voice Recognition system

It allows the users to communicate verbally with the computer. The signal patterns corresponding to the voice are matched against the pre-stored patterns. When a close match is found, the word is recognised by the system.

All the secondary storage devices are commonly used as input/output devices.

Output Devices:

The output device accept data from the primary storage and supply them to the users. Depending upon the applications, there are different types of output devices available.

Visual Display Unit (VDU)

VDU is the most popular output device. In this unit a cathode ray tube that looks like a television screen is used to display the input data as well as the messages and processed output from the computer. No hard copy of the data is obtained using VDU.

Printer

Printer is used to prepare permanent documents in human readable form. The printer uses a printing mechanism to print the characters on the paper. Depending on their speed and approach of printing, printers are classified as character printers, line printers and page printers. There is also another classification according to the type of printing mechanism used. Impact printers use the familiar typewriter approach of hammering a typeface against paper and inked ribbon. Non impact printers do not hit or impact a ribbon to print. They use thermal, electrostatic, chemical and inkjet technologies.

Drum printer, chain printer, dot matrix printer etc. are examples of impact printers. Electromagnetic printers, thermal printers, inkjet printers, laser printers etc. are examples of non-impact printers.

Plotters

A plotter is an output device used to produce hard copies of graphs and designs. Plotters are basically of two types - drum and flat bed plotter. In the drum plotter, the paper on which the design has to be made is placed over a drum that rotates back and forth to produce vertical motion. There are one or more pen which can be moved to produce horizontal motion.

Voice Response Devices

Just as a voice recognition system allows the user to talk to the computer, a voice response system enables a computer to talk to the user. In this system all the sounds needed to process the possible enquiries are pre-recorded. When enquiries are

received, the computer follows a set of rules to create a reply message in a coded form. This coded message is then transmitted to an audio response device.

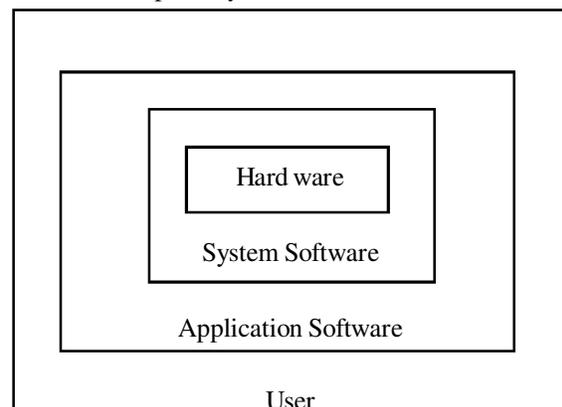
COMPUTER SOFTWARE

The terms hardware and software are frequently mentioned in connection with computers. Hardware refers to the physical devices of a computer system such as input, storage, processor, output devices etc. These hardware units cannot do anything on its own. A sequence of instructions that a computer must perform to solve a problem, written in a language that can be understood by a computer is called a program. The term software refers to a well built program, whose objective is to enhance the capabilities of the hardware machine.

Types of Software

Computer software is normally classified into two broad categories - application software and system software. Application software is a set of one or more programs designed to carry out operations for a specified application. System software also known as a systems package, is a set of one or more programs, designed to control the operation of a computer system. They are general programs written to assist humans in the use of the computer system by performing tasks, such as controlling all of the operations required to move data into and out of a computer and all the steps in executing an application program.

Relation ship between hardware, software and the user of a computer system.



System software consists of the operating system and translating programs.

Firmware

Firmware refers to a sequence of instructions (software) that is substituted for hardware. Computer software in conventional systems is supplied on storage media like floppies, tapes, disks etc. With the advancement in technology and reduction in hardware cost, software is also available in ROM chips. These chips can be plugged into the computer system to form a part of the hardware. Such software made available on hardware is known as firmware.

OPERATING SYSTEM

An operating system is an important component of a computer system which controls all the other components of a computer system. It is a program which acts as an interface between user and the hardware. Major components of a computer system are,

1. Hardware
2. Operating System
3. Application programs
4. Users

The hardware provides the basic computing resources, the application programs define the ways in which these resources are used to solve the computing problems of the users and the operating system controls and coordinates the use of hardware among the various application programs for various users.

The operating system (OS) acts as a resource allocator. Many computer resources are required to solve a problem. Different resources are CPU time, I/O devices, memory space, file storage etc. The OS acts as the manager of these resources and allocates them to specific programs and users as necessary for their tasks, thus maintains the efficiency of the computer.

This control program is responsible for the execution of user programs in an efficient and proper way so as to prevent errors and improper use of the computer.

Types of Operating System Services

The OS provides certain services for the convenience of the programmer, to make the programming task easier. Some common services provided by OS are,

1. Program execution:- The system must be able to load a program in to the memory, run that program and to end the program either normally or abnormally.
2. I/O Operations:- During a program execution the Input/Output operations performed by some devices cannot be controlled by the users, are performed by the operating system.
3. File System manipulation:- The manipulation on file system such as reading, writing and deleting files are performed by OS.
4. Error detection:- The OS constantly checks for errors resulting from CPU, memory, I/O devices, user program etc and appropriate actions are taken for solving the error.
5. Resource allocation:- The OS is responsible for the better allocation of resources among various users so that the efficient utilization of the resources are ensured.
6. Protection:- The independent processes which are executing concurrently in the processor are protected for interfering each other. It also provides security of the system from outside users.

Types of Operating Systems

There are different types of OSs available, which require different types of hardware to run upon.

- i. Single Program OS:- This OS is a single user operating system, so only one user program can be supported and executed by it at any point of time.
- ii. Multiprogram OS:- Unlike the single program OS, this multiprogram OS allows more than one user programs to be loaded and active in the main store at the same time. Actually the multiprogram OS allows the interleaved execution of two or more different and independent programs by the same computer.
- iii. Time Sharing OS:- It is a multiprogrammed multiuser OS. In this, the active user program is given a fair share of CPU time, if the time elapses or an I/O operation is requested, CPU shifts over to the next job waiting and the previous program is put to wait. The active programs are scheduled for execution using certain job scheduling techniques.
- iv. Real time OS:- Real time means immediate

response from the computer. A system in which a transaction accesses and updates a file quickly enough to affect the original decision making is called a real time system. In real time OS, the jobs have fixed dead lines and the jobs have to be completed within their dead lines.

- v. Multiprocessing OS:- The multiprocessing OS is capable of handling more than one processor, as the jobs have to be executed on more than one processor.

Major functions of operating system

1. Processor Management
2. Memory management
3. Input/Output management
4. File management

Processor Management

Processor or process management means the assignment of processor to different tasks, being performed by the computer system. It is also known as CPU scheduling. The scheduling not only assign priority to jobs but also admits new jobs for processing at appropriate times.

There are two different scheduling techniques

- i. Non-pre-emptive scheduling
- ii. Pre-emptive scheduling

Non pre-emptive scheduling - In this type, the scheduled job always completes before another scheduling decision is made. Therefore finishing order of the job is same as their scheduling order. Different non preemptive scheduling are, first come first served (FCFS), shortest job next (SJN) and dead line scheduling.

Pre-emptive Scheduling:- In preemptive scheduling, a scheduling decision can be made even while the job is executing where as in non-preemptive scheduling a scheduling decision is made only after a job completes its execution. The preemptive scheduling may force a job in execution to release the processor so that the execution of some other job can be under taken. Example for preemptive scheduling is round robin scheduling.

Multiprocessor Scheduling

There are two approaches to process management in a multiprocess system.

Master slave configuration:- In this approach one processor controls the process management and other processors only assist the main processor. The master processor decides everything regarding which process is to execute next in which processor and for how long, etc.

Symmetrical multiprocessors:- In this approach, the process management responsibility is shared equally by all the processors in the system. In such configuration any processor can take up a control operation.

Deadlocks

In a multiprogramming environment, general processes may compete for a finite number of resources. A deadlock is a state that occurs when multiple processes are waiting for availability of a resource that will not become available because it is being held by another process that is in a similar wait state. It also occurs when multiple processes are waiting for an action by or a response from another process that is in a similar wait state.

Memory management

In a uniprogramming system, main memory is divided into two parts, one part for the operating system and one part for the program currently being executed. In a multiprogramming system, the user part of memory must be further subdivided to accommodate multiple processes. The memory management system of an OS is responsible for memory subdivision, memory allocation, memory protection etc.

Memory allocation

A program must be assigned some memory area and loaded into memory in order to execute. It is known as memory allocation. When a program terminates, its memory space is declared free, and the next program may be given the same memory area. It is known as memory deallocation.

Contiguous memory allocation:- In this approach, each program which is to be executed is allocated a continuous storage locations. Each job is considered as a single independent entity for allocation. So the OS must ensure that sufficient contiguous memory is available for the program to be executed.

Non contiguous memory allocation:- In this

approach, the program to be executed can be stored in non contiguous memory areas ie, the program is divided into smaller components. These components are then stored in available non contiguous memory areas.

Input/Output management

Because I/O devices inevitably involve mechanical operations, they cannot complete with the micro or nano second speed of the processor and memory. The design of I/O management system largely reflects the need to minimize the problems caused by this disparity. Of central importance is the need to make most of the I/O devices to operate at maximum efficiency.

Device drivers

A device driver is a software module which manages the communication with, and the control of a specific I/O device. It is the task of the device driver to convert the logical requests from the user to specific commands directed to the device itself.

Device Controller

It is a hardware unit which is attached to the I/O bus of the computer and provides a hardware interface between the computer and the I/O device itself. Since it connects the computer bus, the controller is designed for the purposes of a computer system.

Interrupt

The interrupt system is totally essential for the functioning of any operating system. Its purpose is to alert the OS when a number of events occur, so that it can suspend its current activity and deal appropriately with the new situation. This means that the processor can be used to sustain several executing programs and I/O transfers simultaneously, servicing each as the need arises. They are also helpful to compensate the speed differences between the processor and I/O devices.

Direct Memory Access (DMA)

DMA is a technique used to directly transfer data between memory and I/O devices with less effort on the operating system. DMA is often used when dealing large amount of input or output data. The DMA unit has access to the data bus and can transfer data autonomously in and out of memory, and thus reduces the load on the processor. It is not an interrupt because the current program context is not saved and the CPU doesnot do something else.

File Management

A file is a collection of similar records. The file is treated as a single entity by users and applications and may be referenced by name. In some applications the input to the application is by means of a file or output is stored in a file for a long term storage. A file management system is that set of system software that provides services to users and applications, in the use of files.

File management functions

Users and application programs interact with the file system by means of commands for creating and deleting files and for performing operations on files. Before performing any operation, the file system must identify and locate the selected file. This requires the use of some sort of directory that serves to describe the location of all files and their attributes. It requires access control to provide only the authorized users to access a particular file in a particular way.

OS controlled software

A computer can do nothing with a program of instructions and each job must have its own special program. There are many tasks that all computer users require their machine to perform from time to time. It is waste if each user spent a lot of time writing programs for these tasks. So these programs are supplied along with the OS. These OS controlled softwares reduce the time and expense of preparing application programs and are normally grouped according to their purposes. They are language processors linkers, loaders, library programs and utility programs.

Language processors

Language processors also known as translating programs, are system programs that translate a source program written by the user to an object program which is meaningful to the hardware of the computer. These include the assemblers, compilers and interpreters.

Assembler:- Assembler converts a program written in assembly language in to machine language.

Interpreter:- Interpreter converts a high level language program into machine language by converting and executing it line by line. If there is any error in any line, it reports it at the same time and the program execution cannot resume until the error is rectified. Interpreter must be present in the memory every time the program is executed.

Compiler:- Compiler is also used for converting high level language program in to object program. It converts the entire program in one go and reports all the errors of the program. After all the errors are removed, the program is recompiled and after that the compiler is not needed in the memory as the object program is available.

Linkers and loaders

The function of a linker is to take as input, a collection of separate object modules and produce a load module, consisting of an integrated set of object modules.

Once an object program is prepared, that program must be placed into memory before execution. A loader is a program that places object program into memory and prepares them for execution.

Library programs

Library programs consist of frequently used standard routines. These standard routines are called up by the OS wherever they are required in the processing of other programs. This eliminates the need for a programmer to rewrite these modules everytime they are used. Example for commonly used library routines are mathematical functions such as square roots, exponential functions etc.

Utility programs

Utility programs, also known as service programs, are routines that perform needed services such as editing texts or programs, debugging programs to correct logical mistakes, transferring data from one I/O device to another, storing of data etc.

BUSINESS DATA PROCESSING

Data are a collection of facts, unorganized but able to be organized into useful information. Manipulated and well organized data are called information. Processing is a series of actions or operations that convert data into useful information.

The basic building block of data is a character, which consists of letters (A, B, C, Z, a, b,, z), numeric digits (0, 1, 2,, 9) or special characters (+, -, /, *, ,,). These characters are put together to form a field or data item. A field is a meaningful collection of related characters. It is the smallest logical data entity that is treated as single unit in data processing.

Fields are normally grouped together to form a record. A record is a collection of related fields that are treated as a single unit.

Records are grouped to form a file. Then, a file is a number of related records that are treated as a single unit.

A master file is a file which contains almost permanent and usually, the latest data. Where as, a transaction file is a file which contains temporary data and stores such data for a particular time period.

A database is a collection of integrated and related master files. It is a collection of logically related data elements that may be structured in various ways to meet the multiple processing and retrieval needs of different data base users.

File Organizations

There are different methods to organize, access, and process records and files in different ways depending on the type of application and the need of users. The three commonly used file organizations are sequential, direct and indexed sequential organizations. File organization requires the use of some key field or unique identifying value that is found in every record in the file.

Sequential files: In a sequential file, records are stored one after another as ascending or descending order determined by the key field of the records. To access the records the computer must read the file in sequence from the beginning. The first record is read and processed first, then the second record in the file sequence and so on.

Direct files: The direct file consists of records organized in such a way that it is possible for the computer to directly locate the key of the desired record without having to search through a sequence of other records.

Indexed Sequential files: The records in indexed sequential files are organized in sequence and an index table is used to speed up access to the records without requiring a search of the entire file. The records of the file can be stored in random sequence but the index table is in sorted sequence on the key value.

DataBase Management System (DBMS)

A data base management system consists of a collection of interrelated data and a set of programs to access those data in a meaningful way. The primary goal of DBMS is to provide an environment that is both convenient and efficient to use in retrieving and storing database information.

Major components of DBMS are,

1. Data → collection of data to be stored and used
2. Hardware → helps to store and access the data
3. Software → for accessing the stored data efficiently
4. Users → uses the data stored, with the help of software.

Different Kinds of DBMS users

End users: Who interact with the database system by invoking application programs.

Application programmers: Who are professional programmers responsible for developing application programs for the end users. The application programs could be written in a general purpose programming language which includes the commands required to manipulate the database.

Data Base Administrator (DBA): Who is the centralized control of the database. They are responsible for creating, modifying and maintaining the database and also responsible for backup, authorization checks etc.

DATA COMMUNICATION AND COMPUTER NETWORKS

The merging of computers and communication has a considerable influence on the way computer systems are organized. Today, the old mode of a single computer serving all of the organization's computational needs has been replaced by one in which a large number of separate but interconnected computers do the job. These systems are called computer networks.

Computer network means a collection of autonomous computers interconnected by a single technology. Two computers are said to be interconnected if they are able to exchange information. This connection need not be via a copper wire but; fiber optics, microwaves, infra red and communication satellites can also be used. Networks come in many sizes, shapes and forms.

Basic elements of a communication system

Communication is the process of transferring messages from one point to another. The three basic elements of a communication system are,

1. a sender (source) which creates the message to be transmitted.

2. a channel or medium which carries the message.
3. a receiver (sink) which receives the message.

Data communication is the function of transporting data from one point to another. In this case, the sender and receiver are normally machines, in particular, computer devices and the transmission medium may be telephone lines, microwave links, satellite links etc. Unlike computers that process and rearrange data, data communication systems transmit data from one point to another without any change.

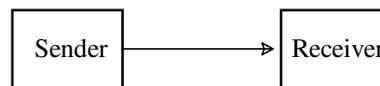
Data Transmission modes

There are three modes for transmitting data from one point to another. They are,

- i. simplex
- ii. half duplex
- iii. full duplex

Simplex mode

If transmission is simplex, the communication is unidirectional. Devices connected to such a system is either a send only or receive only device. For eg: printer communication, TV transmission, Radio transmission etc. This mode of transmission is not an efficient one, since the data receiver could not send any acknowledgement, control or error signal to the sender.



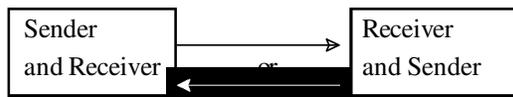
Half duplex mode

A half duplex system can transmit data in both directions, but only in one direction at a time. Thus a half duplex system can alternately send and receive data. This is the most common type of transmission for voice communications because only one person is supposed to speak at a time. It is also used to connect a terminal with a computer. The terminal might transmit data and then the computer responds with an acknowledgement.



Full duplex mode

In a half duplex system, the line must be turned around each time the direction of communication is reversed. This switching time will affect the high speed capabilities of the computer. Also some applications require simultaneous transmission in both directions. In such cases a full duplex system is used, that allows information to flow simultaneously in both directions on the transmission path.



Data Transmission Speed

A term used to describe the data handling capacity of a communication system is bandwidth. Bandwidth is the range of frequencies that is available for the transmission of data. Wider the bandwidth of the communication system, it permits more and rapid information flow.

When dealing with computer input/output devices the speed is in terms of characters per second. However, in case of data transmission, the speed is in terms of bits per second. For data communication, additional bits are added to control the data transfer process. Although the number of bits depends upon the communication system used, commonly encountered systems use a total of either 10 or 11 bits per character. Hence a terminal having a speed of 40 characters per second would probably be used with a communication system which transmits at the rate of 400 bits per second.

Depending on their transmission speeds, communication channels (paths) are grouped into three categories-narrow band, voice band and broad band.

Narrow band

Narrow band or subvoice grade channels range in speed from 45 to 300 baud. They are used for handling low data volumes and are adequate for low speed devices. They are used mainly for telegraph lines and low speed terminals.

Voice band

Voice band channels handle moderate data volumes and can transmit data at speeds upto 9600 baud. They are so called because their major application is for ordinary telephone voice communication. They are also used for data transmission from card reader to CPU or from CPU to line printer. Moreover, most remote terminals are connected to computers through voice band channels.

Broad band

Broad band or wideband channels are used when large volumes of data is to be transmitted at high speed. These systems provide data transmission rate of 1 million baud or more and are used for high speed computer to computer communication or for simultaneous transmission of data to several different devices.

Transmission Media

There are several types of physical channels or transmission media through which data can be transmitted from one point to another. Some of the most common data transmission media are twisted wire pairs, coaxial cables, optical fibres, micro wave system, communication satellite etc.

Optical fibres

In fiber optics, semiconductor lasers transmit information in the form of light along hair-thin glass (optical) fibres at 186,000 miles per second (the speed of light), with no significant loss of intensity over very long distances.

The system basically consists of fiber optic cables that are made of tiny threads of glass or plastic. Towards its source side is a converter that converts electrical signals into light waves. These light waves are transmitted over the fiber. Another converter placed near the sink converts the light waves back to electrical signals by photoelectric diodes. These electrical signals are amplified and sent to the receiver.

Optical fibres may be used to communicate either analog or digital signals. Fiber optic transmissions are not affected by electromagnetic interference. They provide low error rate transmission of signals at very high speeds of 1 giga bits per second.

BANK PROBATIONARY GENERAL AWARENESS

COMPUTER TERMINOLOGY

Basic Terms you need to know. Computer instructions will use these terms repeatedly, and if you don't know them, you will be confused! This reference should help you know what they are talking about. Look through the list when you need a definition, some items are listed together for Mac and PC, so you may not find it under the word you are used to.

- applet**- A small Java application that is downloaded by an ActiveX or Java-enabled web browser. Once it has been downloaded, the applet will run on the user's computer. Common applets include financial calculators and web drawing programs.
- access time** - The performance of a hard drive or other storage device - how long it takes to locate a file.
- active program or window** - The application or window at the front (foreground) on the monitor.
- alert (alert box)** - a message that appears on screen, usually to tell you something went wrong.
- alias** - an icon that points to a file, folder or application.
- application**- Computer software that performs a task or set of tasks, such as word processing or drawing. Applications are also referred to as programs.
- application menu** - on the right side of the screen header. Lists running applications.
- ASCII (pronounced ask-key)** - American Standard Code for Information Interchange. a commonly used data format for exchanging information between computers or programs.
- background** - part of the multitasking capability. A program can run and perform tasks in the background while another program is being used in the foreground.
- backup** - a copy of a file or disk you make for archiving purposes.
- Bandwidth**- A range within a band of frequencies or wavelengths or the amount of data that can be transmitted in a fixed amount of time. For digital devices, the bandwidth is usually expressed in bits per second (bps) or bytes per second
- binary code** - The most basic language a computer understands, it is composed of a series of 0s and 1s. The computer interprets the code to form numbers, letters, punctuation marks, and symbols.
- BIOS** - BIOS stands for Basic Input/Output System and it is a low level program used by your system to interface to computer devices such as your video card, keyboard, mouse, hard drive, and other devices.
- Bit** - A binary unit of data storage that can only be a value of 0 or 1.
- Boot** - A term used to describe what happens to a computer when it is turned on, the operating system begins to run, and then the user is able to use the computer successfully.
- browser** - Software used to navigate the Internet. Netscape Navigator and Microsoft Internet Explorer are today's most popular browsers for accessing the World Wide Web.
- bug** - a programming error that causes a program to behave in an unexpected way.
- bus** - an electronic pathway through which data is transmitted between components in a computer.
- Byte** - 8 bits of data which has a possible value from 0 to 255.
- card** - a printed circuit board that adds some feature to a computer.
- cache**- (pronounced cash) A small data-memory storage area that a computer can use to instantly re-access data instead of re-reading the data from the original source, such as a hard drive. Browsers use a cache to store web pages so that the user may view them again without reconnecting to the Web.
- CAD-CAM**- Computer Aided Drawing-Computer Aided Manufacturing. The instructions stored in a computer that will be translated to very precise operating instructions to a robot, such as for assembling cars or laser-cutting signage.
- cartridge drive** - a storage device, like a hard drive, in which the medium is a cartridge that can be removed.
- CD-ROM disk** - A disk with about 640Mb of storage capacity which are more commonly read than written to.

CD-ROM drive - The hardware component that is used to read a CD-ROM or write to it.

Crash - A common term used to describe what happens to a computer when software errors force it to quit operating and become unresponsive to a computer user.

Chooser - A desk accessory used to select a printer, or other external device, or to log onto a network.

Clock Rate (MHz) - The instruction processing speed of a computer measured in millions of cycles per second (i.e., 200 MHz).

command (apple) key - a modifier key, the Command key used in conjunction with another keystroke to active some function on the Mac.

compiler - a program the converts programming code into a form that can be used by a computer.

compression - a technique that reduces the size of a saved file by elimination or encoding redundancies (i.e., JPEG, MPEG, LZW, etc.)

control key - seldom used modifier key on the Mac.

Cookies- information stored on your hard drive containing data about your preferences and prior visits on certain web pages. Whenever you visit a web site and it seems to "remember you", it's because of cookies. information stored on your hard drive containing data about your preferences and prior visits on certain web pages. Whenever you visit a web site and it seems to "remember you", it's because of cookies.

crash - a system malfunction in which the computer stops working and has to be restarted.

CGI - Common Gateway Interface. A programming standard that allows visitors to fill out form fields on a Web page and have that information interact with a database, possibly coming back to the user as another Web page.

CGI may also refer to Computer-Generated Imaging, the process in which sophisticated computer programs create still and animated graphics, such as special effects for movies.

chat - Typing text into a message box on a screen to engage in dialog with one or more people via the Internet or other network.

client - A single user of a network application that is operated from a server. A client/server architecture allows many people to use the same data simultaneously. The program's main component (the data) resides on a centralized server, with smaller components (user interface) on each client.

cracker- A person who breaks in to a computer

through a network, without authorization and with mischievous or destructive intent (a crime in some states).

Dat Files- Virus definition files that are necessary to keep your McAfee virus scan current and useful. Without the current dat files you are vulnerable to viruses. Short for data.

database - A collection of similar information stored in a file, such as a database of addresses. This information may be created and stored in a database management system (DBMS).

daisy chaining - the act of stringing devices together in a series (such as SCSI).

data - (the plural of datum) information processed by a computer.

defragment - (also - optimize) to concatenate fragments of data into contiguous blocks in memory or on a hard drive.

debug - To find and correct equipment defects or program malfunctions.

default - The pre-defined configuration of a system or an application. In most programs, the defaults can be changed to reflect personal preferences.

desktop publishing - The production of publication-quality documents using a personal computer in combination with text, graphics, and page layout programs.

DHCP- Dynamic Host Configuration Protocol- An IP address is automatically assigned to each computer as needed by the network administrator.

digitize - to convert linear, or analog, data into digital data which can be used by the computer.

disk - Two distinct types. The names refer to the media inside the container:

disk drive - the machinery that writes the data from a disk and/or writes data to a disk.

disk window - the window that displays the contents or directory of a disk.

DOS - acronym for Disk Operating System - used in IBMPCs.

DPI - acronym for Dots Per Inch - a gauge of visual clarity on the printed page or on the computer screen.

A hard disc stores vast amounts of data. It is usually inside the computer but can be a separate peripheral on the outside. Hard discs are made up of several rigid coated metal discs.

domain - Represents an IP (Internet Protocol) address or set of IP addresses that comprise a domain. The domain name appears in URLs to identify web pages or in email addresses.

The name of a network or computer linked to the Internet. Domains are defined by a common IP address or set of similar IP addresses.

Dongle- An adapter cable connecting a special edge-type connector (on a PCMCIA or on-board Ethernet card) to a standard RJ45 Ethernet jack.

Download, Upload- When you copy a file from another computer to your own, you're downloading. You can download files and save them to your computer and also download web pages and view them on your computer. When you copy a file from your computer and save it on another computer, you are uploading that file. Usually uploading occurs when you are creating or maintaining a web page

Driver - A specially written program which understands the operation of the device it interfaces to, such as a printer, video card, sound card or CD ROM drive. It provides an interface for the operating system to use the device.

Drop- In campus buildings, the connector box used to connect your computer to the Ethernet.

Drop-down menu - A menu window that opens vertically on-screen to display context-related options. Also called pop-up menu or pull-down menu.

DSL - Digital Subscriber Line. A method of connecting to the Internet via a phone line. A DSL connection uses copper telephone lines but is able to relay data at much higher speeds than modems and does not interfere with telephone use.

DVD - Digital Video Disc Similar to a CD-ROM, it stores and plays both audio and video.

ebook - An electronic (usually hand-held) reading device that allows a person to view digitally stored reading materials.

email - Electronic mail; messages, including memos or letters, sent electronically between networked computers that may be across the office or around the world.

emoticon - A text-based expression of emotion created from ASCII characters that mimics a facial expression when viewed with your head tilted to the left. Here are some examples: :) Smiling:-(Frowning;-) Winking:_(Crying

encryption - The process of transmitting scrambled data so that only authorized recipients can unscramble it. For instance, encryption is used to scramble credit card information when purchases are made over the Internet.

Ethernet- An Ethernet is a popular type of local-area network (LAN) that many offices use to link computers, printers, and servers.

ethernet card - A board inside a computer to which a network cable can be attached.

expansion slot - a connector inside the computer which allows one to plug in a printed circuit board that provides new or enhanced features.

extension - a startup program that runs when you start the Mac and then enhances its function.

File - A collection of data into a permanent storage structure. Stored on a permanent storage media such as a computer hard drive.

Firmware - Software written into permanent storage into the computer.

firewall - A set of security programs that protect a computer from outside interference or access via the Internet.

Firewire - Apple's AE; Computer's high-speed data transfer. Frequently used to import video to a computer.

fibre channel - as applied to data storage and network topology - link to FC Glossary.

Floppy disk - A low capacity storage media which can be written to as easily as it is read.

Floppy Drive - The hardware component that is used to read or write to a floppy disk.

font - a typeface that contains the characters of an alphabet or some other letterforms.

footprint - The surface area of a desk or table which is occupied by a piece of equipment.

fragmentation - The breaking up of a file into many separate locations in memory or on a disk.

Frames- Today's Web browsers allow site builders to divide the browser window into two or more sections called frames. Each frame is filled with a distinct Web page, but the appearance is of one cohesive page. Frames can be troublesome if you are trying to bookmark or print a certain chunk of data

freeze - a system error which causes the cursor to lock in place.

freeware - Software created by people who are willing to give it away for the satisfaction of sharing or knowing they helped to simplify other people's lives. It may be freestanding software, or it may add functionality to existing software.

FTP- File transfer protocol. This is the method of moving files from one location to another over a network connection.

get info - a Finder File menu command that presents an information window for a selected file icon.

gig - a gigabyte = 1024 megabytes.

glitch - The cause of an unexpected malfunction.

Gopher - An Internet search tool that allows users to access textual information through a series of menus, or if using FTP, through downloads.

GUI- Graphical User Interface. A system that simplifies selecting computer commands by enabling the user to point to symbols or illustrations (called icons) on the computer screen with a mouse.

groupware - Software that allows networked individuals to form groups and collaborate on documents, programs, or databases.

hacker- A person with technical expertise who experiments with computer systems to determine how to develop additional features. Hackers are occasionally requested by system administrators to try and break into systems via a network to test security. The term hacker is sometimes incorrectly used interchangeably with cracker. A hacker is called a white hat and a cracker a black hat.

Hardware - Describes the physical parts of your computer which you can physically touch or see such as your monitor, case, disk drives, microprocessor and other physical parts.

hard copy - A paper printout of what you have prepared on the computer.

head crash - a hard disk crash caused by the heads coming in contact with the spinning disk(s).

high density disk - a 1.4 MB floppy disk.

highlight - to select by clicking once on an icon or by highlighting text in a document.

home page - The main page of a Web site used to greet visitors, provide information about the site, or to direct the viewer to other pages on the site.

HTML - HyperText Markup Language. A standard of text markup conventions used for documents on the World Wide Web. Browsers interpret the codes to give the text structure and formatting (such as bold, blue, or italic).

HTTP - Hypertext Transfer Protocol. A common system used to request and send HTML documents on the World Wide Web. It is the first portion of all URL addresses on the World Wide Web.

HTTPS - Hypertext Transfer Protocol Secure. Often used in intracompany internet sites. Passwords are required to gain access.

hyperlink - Text or an image that is connected by hypertext coding to a different location. By selecting the text or image with a mouse, the computer jumps to (or displays) the linked text.

hypermedia - Integrates audio, graphics, and/or video through links embedded in the main program.

hypertext - A system for organizing text through links, as opposed to a menu-driven hierarchy such as Gopher. Most Web pages include hypertext links to other pages at that site, or to other sites on the World Wide Web.

icons - Symbols or illustrations appearing on the computer screen that indicate program files or other computer functions.

initialize - to format a disk for use in the computer; creates a new directory and arranges the tracks for the recording of data.

input - Data that goes into a computer device.

input device - A device, such as a keyboard, stylus and tablet, mouse, puck, or microphone, that allows input of information (letters, numbers, sound, video) to a computer.

insertion point - in word processing, the short flashing marker which indicates where your next typing will begin.

installer - software used to install a program on your hard drive.

instant messaging (IM) - A chat application that allows two or more people to communicate over the Internet via real-time keyed-in messages.

interface - The interconnections that allow a device, a program, or a person to interact. Hardware interfaces are the cables that connect the device to its power source and to other devices. Software interfaces allow the program to communicate with other programs (such as the operating system), and user interfaces allow the user to communicate with the program (e.g., via mouse, menu commands, icons, voice commands, etc.).

Internet - An international conglomeration of interconnected computer networks. Begun in the late 1960s, it was developed in the 1970s to allow government and university researchers to share information. The Internet is not controlled by any single group or organization. Its original focus was research and communications, but it continues to expand, offering a wide array of resources for business and home users.

interrupt button - a tool used by programmers to enter the debugging mode. The button is usually next to the reset button.

IP (Internet Protocol) address - An Internet Protocol address is a unique set of numbers used to locate another computer on a network. The format of an IP address is a 32-bit string of four numbers

separated by periods. Each number can be from 0 to 255 (i.e., 1.154.10.266). Within a closed network IP addresses may be assigned at random, however, IP addresses of web servers must be registered to avoid duplicates.

ISP - Internet Service Provider is an organization that provides the ability to connect to the internet for their customers. They also usually provide additional services such as e-mail and the ability to host web sites.

Java - An object-oriented programming language designed specifically for programs (particularly multimedia) to be used over the Internet. Java allows programmers to create small programs or applications (applets) to enhance Web sites.

Javascript/ECMA script - A programming language used almost exclusively to manipulate content on a web page. Common Javascript functions include validating forms on a web page, creating dynamic page navigation menus, and image rollovers.

keyboard shortcut - a combination of keystrokes that performs some function otherwise found in a pulldown menu.

landscape - in printing from a computer, to print sideways on the page.

laptop and notebook - Small, lightweight, portable battery-powered computers that can fit onto your lap. They each have a thin, flat, liquid crystal display screen.

LDAP - Lightweight Directory Access Protocol is a software protocol for accessing information directories. Useful when trying to include the contents of the x500 directory in your e-mail client.

Linux - A UNIX-like, open-source operating system developed primarily by Linus Torvalds. Linux is free and runs on many platforms, including both PCs and Macintoshes. Linux is an open-source operating system, meaning that the source code of the operating system is freely available to the public. Programmers may redistribute and modify the code, as long as they don't collect royalties on their work or deny access to their code. Since development is not restricted to a single corporation more programmers can debug and improve the source code faster..

macro - A script that operates a series of commands to perform a function. It is set up to automate repetitive tasks.

Mac OS - An operating system with a graphical user

interface, developed by Apple; for Macintosh computers. Current System X.1 (10) combines the traditional Mac interface with a strong underlying UNIX-like operating system for increased performance and stability.

Mailer Daemon - Daemon is a general term for server processes. The mailer daemon is a server process that handles sending and receiving mail (i.e., the SMTP server).

Measurements (summary) -

a bit = one binary digit (1 or 0)

"bit" is derived from the contraction b'it (binary digit) -> 8 bits = one byte

1024 bytes = one kilobyte

K = kilobyte

Kb = kilobit

MB = megabyte- 1024 kilobytes

Mb = megabit

MB/s = megabytes per second

Mb/s = megabits per second

bps = bits per second

i.e., 155 Mb/s = 19.38 MB/s

memory - Temporary storage for information, including applications and documents. The information must be stored to a permanent device, such as a hard disc or CD-ROM before the power is turned off, or the information will be lost. Computer memory is measured in terms of the amount of information it can store, commonly in megabytes or gigabytes.

menu - a list of program commands listed by topic

merge - To combine two or more files into a single file.

MHz - An abbreviation for Megahertz, or one million hertz. One MHz represents one million clock cycles per second and is the measure of a computer microprocessor's speed. For example, a microprocessor that runs at 300 MHz executes 300 million cycles per second. Each instruction a computer receives takes a fixed number of clock cycles to carry out, therefore the more cycles a computer can execute per second, the faster its programs run. Megahertz is also a unit of measure for bandwidth.

microprocessor - A complete central processing unit (CPU) contained on a single silicon chip.

MIME - multipurpose internet mail extension

minimize - A term used in a GUI operating system that uses windows. It refers to reducing a window to an icon, or a label at the bottom of the screen, allowing another window to be viewed.

modem - A device that connects two computers

together over a telephone or cable line by converting the computer's data into an audio signal. Modem is a contraction for the process it performs: modulate-demodulate.

monitor - A video display terminal.

mouse - A small hand-held device, similar to a trackball, used to control the position of the cursor on the video display; movements of the mouse on a desktop correspond to movements of the cursor on the screen.

MP3 - Compact audio and video file format. The small size of the files makes them easy to download and e-mail. Format used in portable playback devices.

multimedia - Software programs that combine text and graphics with sound, video, and animation. A multimedia PC contains the hardware to support these capabilities.

MS-DOS - An early operating system developed by Microsoft Corporation (Microsoft Disc Operating System).

nanosecond - one billionth of a second. (or, the time between the theatrical release of a Dudley Moore film and the moment it begins to play on air-planes).

native mode - using the computers original operating system; most commonly used when talking about the PowerPC can run software written for either the 80x0 systems, or the PowerPC's RISC code.

Network - A general term describing to the cables and electronic components that carry data between computers. It is also generally used to refer to the server computers that provide services such as printing, file sharing, e-mail, and other services.

Newsgroups, Usenet - Newsgroups, sometimes called Usenet, are public discussions posted for anyone who is interested in reading them. While similar in appearance to e-mail, newsgroups are messages that are posted to all members of the group and not addressed to an individual person.

NuBus - expansion slots on the Mac which accept intelligent, self-configuring boards. NuBus is a different bus architecture than the newer PCI bus and the boards are not interchangeable.

open source - Computer programs whose original source code was revealed to the general public so that it could be developed openly. Software licensed as open source can be freely changed or adapted to new uses, meaning that the source code of the operating system is freely available

to the public. Programmers may redistribute and modify the code, as long as they don't collect royalties on their work or deny access to their code. Since development is not restricted to a single corporation more programmers can debug and improve the source code faster.

operating system - A set of instructions that tell a computer on how to operate when it is turned on. It sets up a filing system to store files and tells the computer how to display information on a video display. Most PC operating systems are DOS (disc operated system) systems, meaning the instructions are stored on a disc (as opposed to being originally stored in the microprocessors of the computer). Other well-known operating systems include UNIX, Linux, Macintosh, and Windows.

optical disk - a high-capacity storage medium that is read by a laser light.

output - Data that come out of a computer device. For example, information displayed on the monitor, sound from the speakers, and information printed to paper.

palm - A hand-held computer.

Parallel - A data transmission method where data is sent on more than one line at a time. This may be any number of bits at a time, but is usually one word at a time (two bytes) or possibly three bytes at a time.

partition - a subdivision of a hard drives surface that is defined and used as a separate drive.

PC - acronym for personal computer, commonly used to refer to an IBM or IBM clone computer which uses DOS.

PCI - acronym for Peripheral Component Interchange - the newer, faster bus architecture.

PDA - Personal Digital Assistant. A hand-held computer that can store daily appointments, phone numbers, addresses, and other important information. Most PDAs link to a desktop or laptop computer to download or upload information.

PDF - Portable Document Format. A format presented by Adobe Acrobat that allows documents to be shared over a variety of operating systems. Documents can contain words and pictures and be formatted to have electronic links to other parts of the document or to places on the web.

peripheral - Any external device attached to a computer to enhance operation. Examples include external hard drive, scanner, printer, speakers,

keyboard, mouse, trackball, stylus and tablet, and joystick.

petabyte - A measure of memory or storage capacity and is approximately a thousand terabytes.

petaflop - A theoretical measure of a computer's speed and can be expressed as a thousand-trillion floating-point operations per second.

point - (1/72") 12 points = one pica in printing.

pop-up menu - any menu that does not appear at the top of the screen in the menu bar. (may pop up or down)

Power PC - a processing chip designed by Apple, IBM and Motorola (RISC based).

Power Mac - a family of Macs built around the PowerPC chip.

print spooler - a program that stores documents to be printed on the hard drive, thereby freeing the memory up and allowing other functions to be performed while printing goes on in the background.

Protocols - A standard method used for communications or other internet and network functions.

Plug-in - a subordinate application to your internet browser that allows for more specialized content to be displayed or otherwise dealt with. Flash, Quick Time, Real Player, and Adobe Acrobat Reader are all Plug-ins

plug and play - Computer hardware or peripherals that come set up with necessary software so that when attached to a computer, they are recognized by the computer and are ready to use.

pop-up menu - A menu window that opens vertically or horizontally on-screen to display context-related options. Also called drop-down menu or pull-down menu.

Power PC - A competitor of the Pentium chip. It is a new generation of powerful sophisticated microprocessors produced from an Apple-IBM-Motorola alliance.

program - A precise series of instructions written in a computer language that tells the computer what to do and how to do it. Programs are also called software or applications.

programming language - A series of instructions written by a programmer according to a given set of rules or conventions (syntax). High-level programming languages are independent of the device on which the application (or program) will eventually run; low-level languages are specific to each program or platform. Programming language instructions are converted into

programs in language specific to a particular machine or operating system (machine language) so that the computer can interpret and carry out the instructions. Some common programming languages are BASIC, C, C++, dBASE, FORTRAN, and Perl.

Proxy - A software agent that acts on behalf of a user as a bridge over secure networks by authenticating your identity and then helping you to access the server.

puck - An input device, like a mouse. It has a magnifying glass with crosshairs on the front of it that allows the operator to position it precisely when tracing a drawing for use with CAD-CAM software.

pull-down menu - A menu window that opens vertically on-screen to display context-related options. Also called drop-down menu or pop-up menu.

Pulse - name of the web server for the main Tulane web site and faculty and staff websites.

push technology - Internet tool that delivers specific information directly to a user's desktop, eliminating the need to surf for it. PointCast, which delivers news in user-defined categories, is a popular example of this technology.

QuickTime - the Apple system extension that gives one the ability to compress, edit and play animation, movies and sound on the Mac.

Radio Button - a graphical way to force a user to make only one selection from a list of options. Radio buttons are represented by a group of small circles. When you click on one of them, you get a dot on your selection. There is always a default selection.

RAID - Redundant Array of Inexpensive Disks. A method of spreading information across several disks set up to act as a unit, using two different techniques:

Disk striping: storing a bit of information across several discs (instead of storing it all on one disc and hoping that the disc doesn't crash).

Disk mirroring: simultaneously storing a copy of information on another disc so that the information can be recovered if the main disc crashes.

Reboot - To restart a computer. It comes from "boot," which is a term that means starting the operating system on the computer. When your computer starts going haywire, your first course of action should be to reboot.

reset switch - a switch on the Mac that restarts the computer in the event of a crash or freeze.

resize box - the small square at the lower right corner of a window which, when dragged, resizes the window.

RISC - acronym for Reduced Instruction Set Computing; the smaller set of commands used by the PowerPC and Power Mac.

Rj45 Cable- proper name for the wire or cable used to connect your computer to the ethernet.

Router- A device that bridges an internal network to another network. Take a ferry as an example: cars that need to go to the other side of a body of water (another network) need to use the ferry (the router). If they want to stay on their side, they simply don't go on the ferry. Also a device used to bridge a computer to a long distance digital communications network, such as ISDN.

Rs6000- The name commonly used to refer to the server cluster at Tulane. The RS/6000 complex is comprised of six IBM spnodes in an SP2, each of which use the Reduced Instruction Set Computer (RISC) architecture. Each node offers multi-user, multi-tasking capabilities for numerically-intensive scientific applications, graphics engineering applications, and input/output (I/O)-intensive applications. The RS/6000s' operating systems are AIX, which is IBM's implementation of UNIX System V Release 3. It's compatible with Berkeley Software Distribution (BSD) 4.3 and conforms to the IEEE Portable Operating System for Computer Environments (POSIX) Systems Application Programming interface. It implements the C, Bourne, and Korn command shells. On Tulane's RS/6000 Complex the C shell is the default. For a more detailed explanation, click here.

Rs6000 account- Tulane Technology account on the rs6000 cluster. This account will allow you access to e-mail, dial in to the Tulane server from off campus, allow you to apply for a Blackboard account, access storage space on the rs6000, and serve as the backbone for your computing career at Tulane. In general when you see any mention of logon or user name, you'll want to enter your rs6000 user name.

root directory - the main hard drive window.

Safe Mode - This is a Windows 95 mode that is automatically loaded if Windows crashes during boot up. You can access Safe Mode anytime if you press the "F8" key when the screen says "loading Windows." This will bring you to a menu

that allows you to boot into safe mode. Safe Mode is a special mode of Windows that loads with minimal driver support. The purpose of it is to help resolve boot problems. For example, if you install the wrong graphics driver, Windows crashes when it's loading. When you restart Windows, it will boot into Safe Mode and use the standard VGA driver with 60 Hz refresh rate. This will allow you to go to the Display Properties function and switch the video driver back to something that works. There is no reason to go into Safe Mode unless you are crashing during boot up or you are trying to diagnose a driver problem.

save - to write a file onto a disk.

save as - (a File menu item) to save a previously saved file in a new location and/or with a new name.

Scroll- Moving up or down within a document in your screen by clicking on the directional arrows found on the right side and bottom of the active window.

scroll bar - a bar at the bottom or right side of a window that contains the scroll box and allows scrolling.

scroll box - the box in a scroll bar that is used to navigate through a window.

SCSI address - a number between zero and seven that must be unique to each device in a SCSI chain. Fast and Wide SCSI devices will allow up to 15 SCSI Ids (hexidecimal); however, the length restriction (3 meters) is such that it is virtually impossible to link 15 devices together.

SCSI terminator - a device placed at the end of a SCSI chain to complete the circuit. (some SCSI devices are self-terminating, or have active termination and do not require this plug).

Secure Sockets Layer (SSL) - This is a protocol specified by Netscape that allows for "secure" passage of data. It uses public key encryption, including digital certificates and digital signatures, to pass data between a browser and a server. It is an open standard and is supported by Netscape's Navigator and Microsoft's Internet Explorer.

search engine - Software that makes it possible to look for and retrieve material on the Internet, particularly the Web. Some popular search engines are Alta Vista, Google, HotBot, Yahoo!, Web Crawler, and Lycos.

Security flaw - A software bug allowing an attacker a method to gain unauthorized access to a system.

Serial - A data transmission method where data is sent on a single line and one bit is sent at a time. This is similar to a line which one item must come one after another

Software - Describes the programs that run on your system.

SPAM - A term used to describe junk and unsolicited e-mail.

Storage Media - A term used to describe any magnetic device that computer data can be permanently stored on such as a hard drive or floppy drive.

shareware - Software created by people who are willing to sell it at low cost or no cost for the gratification of sharing. It may be freestanding software, or it may add functionality to existing software.

Site License - Usually, software manufacturers will sell their software based on the amount of users using the software. As the amount of users increases, and prices get higher, software manufacturers will sometimes sell a site license that entitles an entire site to use as many licenses as they need to at a particular location for a single price. This makes management of a large amount of licenses unnecessary and simplifies things for the customer and the software vendor. For example, one company may have a 1-user, 5-user, 10-user, 25-user and finally a site-license version of their software. The site license will be the most expensive, but may be more economical if you have a large amount of users.

Spam- unsolicited junk e-mail. Spammers will often offer you the option of removing yourself from their e-mailing list. But more often than not they use non-functioning return e-mail addresses or anonymous remailers so it's difficult to successfully unsubscribe from their lists (though recent legislation has been passed outlawing this behavior). However you're not helpless: Tools like e-mail filters and a spam-abuse hotline (spam.abuse.net) do provide help for dealing with spam.

System Tray- The system tray is the place holder on the far right of the Windows taskbar. Within it you will find the clock and other user-installed programs that monitor the system or run constantly. To see what each icon represents, simply hold your mouse pointer over an icon, or right click an icon for a menu of options.

server - a central computer dedicated to sending and receiving data from other computers (on a network).

shut down - the command from the Special menu that shuts down the Mac safely.

spider - A process search engines use to investigate new pages on a web site and collect the information that needs to be put in their indices.

SSH- Program that allows secure file transfer over a network connection.

storage - Devices used to store massive amounts of information so that it can be readily retrieved. Devices include RAIDs, CD-ROMs, DVDs

Streaming - Taking packets of information (sound or visual) from the Internet and storing it in temporary files to allow it to play in continuous flow.

start up disk - the disk containing system software and is designated to be used to start the computer.

surge suppressor - a power strip that has circuits designed to reduce the effects of surge in electrical power. (not the same as a UPS)

System file - a file in the System folder that allows your Mac to start and run.

System folder - an all-important folder that contains at least the System file and the Finder.

TCP/IP- Abbreviation for Transmission Control Protocol/Internet Protocol, the suite of communications protocols used to connect hosts on the Internet.

Telnet- Telnet is a program that runs on your computer and allows you to connect to a remote host (computer). As an emulation program, the commands you enter through telnet are executed as if you were typing them directly into the host's keyboard. To prevent unauthorized people from accessing data, only folks with a valid username and password are allowed to connect.

Tucan- TUCAN is Tulane's privately owned and operated cable TV system. All students who live on the campus have a free cable television outlet in their residence hall rooms.

Uninterruptible Power Source (UPS)- a constantly charging battery pack which powers the computer. A UPS should have enough charge to power your computer for several minutes in the event of a total power failure, giving you time to save your work and safely shut down.

URL- Uniform Resource Locator is the term used to describe a link which points to a location of a file

on the internet. Every single thing you see on the Web has its own distinct address, or URL. Web pages, images, scripts, and other various multimedia shenanigans all have a distinct location, which more often than not begins with "HTTP" (which stands for "hypertext transfer protocol") followed by a colon and two slashes (http://). That, in combination with the file location, www.tulane.edu/~tis, makes up a URL.

USB - Universal Serial Bus. An industry standard for connecting different compatible peripheral devices across multiple platforms. USB peripherals offer the use of plug-and-play convenience by eliminating the need to turn off or restart the computer when attaching a new peripheral. Users can connect USB peripherals whenever they need them.

Userid- usually your first initial and last name, as assigned to you by Technology Services. Also the first part of your @Tulane.edu e-mail address.

virtual memory - using part of your hard drive as though it were "RAM".

virtual reality (VR) - A technology that allows one to experience and interact with images in a simulated three-dimensional environment. For example, you could design a room in a house on your computer and actually feel that you are walking around in it even though it was never built. (The Holodeck in the science-fiction TV series Star Trek: Voyager would be the ultimate virtual reality.) Current technology requires the user to wear a special helmet, viewing goggles, gloves, and other equipment that transmits and receives information from the computer.

virus - An unauthorized piece of computer code attached to a computer program or portions of a computer system that secretly copies itself from one computer to another by shared discs and over telephone and cable lines. It can destroy information stored on the computer, and in extreme cases, can destroy operability. Computers can be protected from viruses if the operator utilizes good virus prevention software and keeps the virus definitions up to date. Most viruses are not programmed to spread themselves. They have to be sent to another computer by e-mail, sharing, or applications. The worm is an exception, because it is programmed to replicate itself by sending copies to other

computers listed in the e-mail address book in the computer. There are many kinds of viruses, for example:

Boot viruses place some of their code in the start-up disk sector to automatically execute when booting. Therefore, when an infected machine boots, the virus loads and runs.

File viruses attached to program files (files with the extension .exe). When you run the infected program, the virus code executes.

Macro viruses copy their macros to templates and/or other application document files.

Trojan Horse is a malicious, security-breaking program that is disguised as something benign such as a screen saver or game.

Worm launches an application that destroys information on your hard drive. It also sends a copy of the virus to everyone in the computer's e-mail address book.

Vulnerability - Software errors that allow some kind of unauthorized access when they are used or exploited.

Word - Two bytes or 16 bits of data with a possible unsigned value from 0 to 16535.

Worm - A term used to describe an unwanted program that uses system or application vulnerabilities to infect a computer without the user doing anything but connecting to an infected network

WORM - acronym for Write Once-Read Many; an optical disk that can only be written to once (like a CD-ROM).

World Wide Web (WWW or the Web) - A network of servers on the Internet that use hypertext-linked databases and files. It was developed in 1989 by Tim Berners-Lee, a British computer scientist, and is now the primary platform of the Internet. The feature that distinguishes the Web from other Internet applications is its ability to display graphics in addition to text.

X500- Online directory available to the Tulane community that contains e-mail and physical mailing addresses. Updated monthly via an interface with the Payroll/personnel and student information systems.

zoom box - a small square in the upper right corner of a window which, when clicked, will expand the window to fill the whole screen

MULTIPLE CHOICE QUESTIONS

1. Which of the following is the product of data processing
 - a. information
 - b. data
 - c. software program
 - d. system
2. The process of putting data into a storage location is called
 - a. reading
 - b. writing
 - c. controlling
 - d. hand shaking
3. The process of copying data from a memory location is called
 - a. reading
 - b. writing
 - c. controlling
 - d. booting
4. A list of instructions used by a computer is called
 - a. program
 - b. CPU
 - c. text
 - d. output
5. The CPU consists of
 - a. input, output and processing
 - b. control unit, primary storage and secondary storage
 - c. Control unit; arithmetic logic unit and primary storage
 - d. input, processing and storage
6. Which of the following is true about primary storage
 - a. it is a part of the CPU
 - b. It allows very fast access to data
 - c. It is relatively more expensive
 - d. all of the above
7. Which of the following is the most powerful type of the computer
 - a. main frame
 - b. super conductor
 - c. micro computer
 - d. super computer
8. Software instruction intended to satisfy a user's specific processing needs are called
 - a. system software
 - b. process software
 - c. documentation
 - d. application software
9. The computer device primarily used to provide hardcopy is the
 - a. CRT
 - b. line printer
 - c. computer console
 - d. card reader
10. Which one of the following can produce the final product of machine processing in a form usable by humans
 - a. storage
 - b. control
 - c. input device
 - d. output device
11. The term 'memory' applies to which one of the following
 - a. logic
 - b. storage
 - c. input device
 - d. output device
12. A program written in machine language is called program.
 - a. object
 - b. computer
 - c. assembler
 - d. high level
13. A source program is the program written in language.
 - a. English
 - b. symbolic
 - c. high level
 - d. object
14. A typical modern computer uses
 - a. magnetic cores for secondary storage
 - b. LSI chips
 - c. magnetic tape for primary memory
 - d. more than 10,000 vacuum tubes
15. A collection of 8 bits is called
 - a. byte
 - b. record
 - c. word
 - d. nibble
16. General purpose computers are those that can be adopted to countless uses simply by changing its
 - a. output device
 - b. input device
 - c. processor
 - d. program
17. The current generation of computers
 - a. second
 - b. fifth
 - c. fourth
 - d. third
18. The boolean expression $(A + \bar{C})(\bar{B} + \bar{C})$ simplifies to
 - a. $\bar{C} + A\bar{B}$
 - b. $\bar{C}(\bar{A} + B)$
 - c. $\bar{B}\bar{C} + \bar{A}$
 - d. None of these
19. To implement all functions of the basic logic functions, it needs
 - a. OR gate
 - b. NOT gate
 - c. AND and NOT gates
 - d. None of these
20. In the binary number 110.101, the fractional part has the value
 - a. 0.625
 - b. 0.125
 - c. 0.875
 - d. 0.5
21. The value of binary 1111 is
 - a. $2^3 - 1$
 - b. 2^4
 - c. $2^4 - 1$
 - d. None of these
22. The value of 2^5 in octal system is
 - a. 20
 - b. 40
 - c. 400
 - d. None of these
23. A hexa decimal number 'AO' has the decimal value
 - a. 80
 - b. 256
 - c. 100
 - d. 160

24. The binary representation of hexadecimal 'C3' is
a. 1111 b. 110011
c. 110001 d. 11000011
25. The ASCII code is for information interchange by a binary code for
a. numbers only b. alphabets only
c. alphanumeric and other common symbols
d. None of these
26. A four bit number is given as 1001. Its 1's complement is
a. 1001 b. 11001
c. 0110 d. 0101
27. 2's complement representation of a decimal number -4 is
a. 0100 b. 1100
c. 1011 d. 1010
28. BCD numbers are obtained
a. by converting decimal number to binary
b. by converting decimal to octal
c. when each decimal digit is represented by four bit binary
d. by converting binary to decimal.
29. A gate in which all inputs must be low to get a high output is called
a. an inverter b. a NOR gate
c. an AND gate d. a NAND gate
30. For a logical circuit there are 'n' binary inputs. Then the number of different input combinations in the truth table is
a. 2n b. 2/n
c. 2ⁿ d. 2(n+1)
31. Which of the following performs modulation and demodulation
a. Satellite b. modem
c. fiber optic d. amplifier
32. A characteristic of multiprogramming system is
a. simultaneous execution of program instructions from two applications
b. concurrent processing of two or more programs
c. multiple CPU's d. all of the above
33. Communication circuits that transmit data in both directions but not at the same time are operating in
a. simplex mode b. half-duplex mode
c. full-duplex mode d. asynchronous mode
34. Operating system functions may include
a. input/output control b. virtual storage
c. multiprogramming d. all of the above
35. Transmission of computerised data from one location to another is called
a. data transfer b. data flow
c. data communication d. datamanagement
36. Which of the following items is not used in LAN
a. computers b. modem
c. printer d. cable
37. Which is the device that converts computer output into a form that can be transmitted over a telephone line
a. teleport b. multiplexer
c. concentrator d. modem
38. What is the commonly used unit for measuring the speed of data transmission
a. bytes per second b. bits per second
c. baud d. either b or d
39. A kilobyte also referred to as KB, is equal to
a. 1000 bytes b. 1024 bytes
c. 2048 bytes d. 512 bytes
40. Inputs to your computer is accomplished using the
a. Screen b. keyboard
c. printer d. plotter
41. Which of the following is not used as secondary storage
a. Semiconductor memory
b. magnetic disks
c. magnetic drums
d. magnetic tapes
42. A collection of wires that connects several device is called
a. link b. bus
c. cable d. port
43. A offline device is
a. a device which is not connected to CPU
b. a device which is connected to CPU
c. a device which is in breakdown stage
d. None of these
44. Which of the following is the fastest
a. CPU
b. magnetic tapes and disks
c. video terminal
d. sensors, mechanical controllers
45. Memories in which any location can be reached in a fixed and short amount of time after specifying its address is called
a. sequential access memory
b. random access memory
c. secondary memory
d. mass storage

46. The register which contains the data to be written into or read out of the addressed location is known as
a. index register
b. memory address register
c. memory data register
d. program counter
47. The register which keeps track of the execution of a program and which contains the memory address of the next instruction to be executed is known as
a. index register b. instruction register
c. memory address register
d. program counter
48. Which of the following is used as storage locations both in the ALU and in the control section of a computer
a. accumulator b. register
c. adder d. decoder
49. Accumulator is a
a. hardwired unit b. sequential circuit
c. finite state machine d. register
50. Non volatility is an important advantage of
a. CCDs
b. magnetic tapes and disks
c. magnetic bubbles d. both b and c
51. Which of the following memory is volatile
a. RAM b. ROM
c. EPROM d. PROM
52. The memory which is programmed at the time it is manufactured is
a. ROM b. RAM
c. PROM d. EPROM
53. Which memory is non volatile and may be written only once.
a. RAM b. EE-PROM
c. EPROM d. PROM
54. Which of the following statements is wrong
a. magnetic core memory, RAMs and ROMs have constant access time b .
magnetic tape is non volatile
c. semiconductor memories are used as mass memory medium
d. An EPROM can be programmed, erased and reprogrammed by the user with an EPROM programming instrument
55. The fastest type of memory is
a. tape
b. semiconductor memory
c. disk d. bubble memory
56. In magnetic disks data is organized on the platter in a concentric sets or rings called
a. sector b. track
c. head d. block
57. When we move from the outer most track to the innermost track in a magnetic disk, the density
a. increases b. decreases
c. remains the same
d. either remains constant or decreases
58. Which of the following device can be used to directly input printed text
a. OCR b. Mouse
c. MIC d. Joystick
59. Which device can draw continuous lines
a. daisy wheel b. plotter
c. chain printer d. impact printer
60. In which storage device, recording is done by burning tiny pits on a circular disk
a. punched cards b. floppy disk
c. magnetic tape d. optical disk
61. Which of the following printers uses light beam and electrostatically sensitive black powder
a. dot matrix printer b. daisy wheel printer
c. chain printer d. laser printer
62. The primary purpose of an operating system is
a. to make the most efficient use of the computer hardware
b. to allow people to use the computer
c. to keep system programmers employed
d. to make computers fast.
63. The operating system manages
a. memory b. processor
c. disk and I/O devices d. all of the above
64. Scheduling is
a. allowing job to use the processor
b. unrelated performance considerations
c. quiet simple to implement, even on large main frames
d. the same regardless of the purpose of the system
65. Which of the following translator program converts assembly language program to object program
a. assembler b. compiler
c. macroprocessor d. linker
66. Multiprogramming systems
a. are easier to develop than single programming systems

- b. execute each job faster
 c. execute more jobs in the same time period
 d. use only one large mainframe computer
67. What device is used for entering x - y coordinates
 a. card reader b. joystick
 c. keyboard d. all of the above
68. Impact printers
 a. strike a ribbon against the paper to produce character images.
 b. include ink-jet and thermal devices
 c. are more expensive than laser printers
 d. use optical technology
69. Bar codes stores information using
 a. punched holes b. dots
 c. thick and thin tines d. all of the above
70. How many types of storage loops exist in magnetic bubble memory
 a. 8 b. 4 c. 3 d. 2
71. In comparison to the internal (main) memory, tape or disk memory is
 a. slower and more expensive
 b. slower and less expensive
 c. faster and more expensive
 d. faster and less expensive
72. One of the main features that distinguish microprocessor from microcomputers is
 a. words are usually larger in microprocessors
 b. words are shorter in microprocessors
 c. microprocessor doesnot contain I/O devices
 d. computers are not fully integrated
73. microprocessor with 'n' address lines is capable of addressing
 a. $2n$ locations b. $2^{(n+1)}$ locations
 c. 2^n locations d. n^2 locations
74. Which technique is preferable for transferring a large amount of data to and from a memory in a short time
 a. DMA b. Interrupt driven I/O
 c. programmed I/O d. None of these
75. Boolean expression for the output of X-NOR (equivalence) logic gate with inputs A and B is
 a. $\overline{A}\overline{B} + \overline{A}B$ b. $\overline{A}\overline{B} + AB$
 c. $(\overline{A} + B)(A + \overline{B})$ d. $(\overline{A} + \overline{B})(A + B)$
76. The binary representation 100110 is numerically equivalent to
 a. the decimal representation 46
 b. the octal representation 46
 c. the hexadecimal representation 46
 d. the binary representation 26
77. The Boolean expression $\overline{A}.B + A.\overline{B} + A.B$ is equivalent to
 a. $A + B$ b. $\overline{A}.B$
 c. $\overline{A + B}$ d. $A . B$
78. The greatest negative number which can be stored in a computer that has 8-bit wordlength and uses 2's complement arithmetic is
 a. -256 b. -255 c. -128 d. -127
79. By taking 2's complement again of the 2's complement of a binary, one gets
 a. the 1's complement b. the 2's complement
 c. the original number
 d. the sign magnitude form of the numbers
80. The expression $A(A + B)$ by writing the first term A as $A + 0$ the expression is best simplified as
 a. $A + AB$ b. AB
 c. A d. $A + B$
81. In the sign magnitude representation, the leading bit
 a. is a part of the number itself
 b. is unit for positive numbers
 c. is always unit
 d. stands for the sign
82. Which of the following is equivalent to the Boolean expression $Y = \overline{A}\overline{B} + \overline{B}\overline{C} + \overline{C}\overline{A}$
 a. $\overline{AB + BC + CA}$
 b. $(\overline{A} + \overline{B}) + (\overline{B} + \overline{C}) + (\overline{A} + \overline{C})$
 c. $\overline{(A + B)(B + C)(C + A)}$
 d. $\overline{(A + B)} \overline{(B + C)} \overline{(C + A)}$
83. The OSI reference model defines the function for seven layers of protocols
 a. including the user and communication medium.
 b. not including the user or communication medium
 c. including the communication medium but not the user
 d. including the user but not the communication medium
84. The OSI reference model is
 a. worthless b. a protocol
 c. not a protocol d. None of these
85. A data packet is a packet header together with
 a. a network layer
 b. an administrative layer
 c. user data
 d. a packet switch

86. The application layer of the OSI model is the
a. seventh layer b. sixth layer
c. fifth layer d. fourth layer
87. Working of the WAN generally involves
a. satellite b. frame delay
c. ATM d. user agent
88. Which of the following technique provides dedicated communication channel between two stations.
a. switch network b. circuit switching
c. packet switching d. none of these
89. End-to-end connectivity is provided from host-to-host in
a. network layer b. session layer
c. data link layer d. transport layer
90. Base band is
a. transmission of signals without modulation
b. a signal all of whose energy is contained within a finite frequency range.
c. the simultaneous transmission of data to a number of stations
d. all of the above
91. The simultaneous transmission of data to a number of stations is known as
a. broad cast b. bandwidth
c. Aloha d. analog transmission
92. The communication mode that supports data in both directions
a. simplex b. half duplex
c. duplex d. multiplex
93. Modulation is the process of
a. sending a file from one computer to another computer
b. converting digital signals to analog signals
c. converting analog signals to digital signals
d. echoing every character that is received
94. A distributed network configuration in which all data/information pass through a central computer is
a. bus network b. star network
c. duplex d. multiplex
95. To connect a computer with a device in the same room, you might be likely to use
a. a coaxial cable b. a dedicated time
c. a ground station d. all of the above
96. Administrative supervision of database activities is the responsibility of the
a. data base administrator
b. DP Manager
c. DB Manager
d. VP-DP administrator
97. Which of the following component of a computer system is the most important to a data base management system
a. mouse
b. high resolution video display
c. printer
d. high speed, large capacity disk
98. What is the serious problem(s) of file management systems
a. data redundancy b. difficult to update
c. program dependence
d. All of the above
99. Which of the following contains complete record of all activity that affected the contents of a database during a certain period of time
a. master file b. transaction file
c. report d. query file
100. In a database, related fields are grouped to form
a. record b. file
c. bank d. field group
101. A table consists of
a. fields and columns b. rows and columns
c. rows and cells d. none of these
102. The purpose of an index is to provide to the file it is indexing
a. storage area b. access path
c. name d. number
103. The database environment has all of the following components except
a. users b. separate files
c. database d. database administrator
104. Which of the following is an advantage of the database approach
a. elimination of data redundancy
b. ability to associate related data
c. increased security
d. All of the above
105. When changes occur in a data item, if every file which contains that field should not be updated then, it leads to
a. data redundancy b. data inconsistency
c. data security d. data loss
106. When the same data field is stored more than once in a file, then it leads to
a. data redundancy b. data inconsistency
c. data dependancy d. data independancy
107. Data security threats include
a. privacy invasion b. hardware failure
c. fraudulent manipulation of data
d. all of the above

108. Updating a database means
 a. revising a file structure
 b. reorganizing the database
 c. modifying or adding records
 d. all of the above
109. Firmware means
 a. software b. hardware
 c. software available on hardware
 d. none of these
110. For each instructions of program in memory the CPU goes through a
 a. decode - fetch - execute sequence
 b. execute - store - decode sequence
 c. fetch - decode - execute sequence
 d. fetch - execute - decode sequence
111. Which of the following is the ascending order of data hierarchy
 a. bit - byte - record - field - data base - file
 b. bit - byte - field - record - file - database
 c. bit - byte - file - field - record - database
 d. bit - record - byte - field - file - database
112. A microcomputer consists of atleast an input unit, an output unit, microprocessor unit and a
 a. stabilizer b. memory unit
 c. printer d. network
113. Magnetic tape can serve as
 a. input media
 b. output media
 c. secondary storage media
 d. all of the above
114. Super computers are mainly useful for
 a. mathematical intensive scientific applications
 b. data-retrieval operations
 c. input-output intensive processing
 d. all of the above
115. Which of the following storage is volatile
 a. semiconductor memory
 b. floppy disk
 c. CD-ROM
 d. core memory
116. RAM chips
 a. allow the computer to store data electronically
 b. store data indefinitely unless you delete it
 c. are secondary memory
 d. all of the above
117. EEPROM is
 a. easily erasable b. non-erasable
 c. effectively erasable d. electrically erasable
118. Multiprocessing
 a. makes the operating system simpler
 b. allows multiple processes to run simultaneously
 c. is completely understood by all major computer vendors
 d. allows the same computer to have multiple processors
119. How many units in a single bus structure will communicate at a time
 a. 1 b. 2 c. 3 d. 14
120. Arithmetic logic unit
 I. perform arithmetic operations
 II. store data
 III. perform comparison
 IV. communicate with input devices of the above
 the correct one is
 a. I only b. II only
 c. I and II only d. I and III only

ANSWERS

- | | | | | | | | | | | |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 1. a | 2. b | 3. a | 4. a | 5. c | 6. d | 7. d | 8. d | 9. b | 10. d | 11. b |
| 12. a | 13. c | 14. b | 15. a | 16. d | 17. c | 18. a | 19. c | 20. a | 21. c | 22. b |
| 23. d | 24. d | 25. c | 26. c | 27. b | 28. c | 29. b | 30. c | 31. b | 32. b | 33. b |
| 34. d | 35. c | 36. b | 37. d | 38. d | 39. b | 40. b | 41. a | 42. b | 43. a | 44. a |
| 45. b | 46. c | 47. d | 48. b | 49. d | 50. d | 51. a | 52. a | 53. d | 54. c | 55. b |
| 56. b | 57. a | 58. a | 59. b | 60. d | 61. d | 62. a | 63. d | 64. a | 65. b | 66. c |
| 67. b | 68. a | 69. c | 70. d | 71. b | 72. c | 73. c | 74. a | 75. c | 76. b | 77. a |
| 78. c | 79. c | 80. c | 81. d | 82. c | 83. b | 84. c | 85. c | 86. a | 87. a | 88. b |
| 89. d | 90. a | 91. a | 92. b | 93. b | 94. b | 95. a | 96. a | 97. d | 98. d | 99. b |
| 100. a | 101. b | 102. b | 103. b | 104. d | 105. b | 106. a | 107. d | 108. d | 109. c | 110. c |
| 111. b | 112. b | 113. d | 114. a | 115. a | 116. a | 117. d | 118. d | 119. b | 120. d | 102. b |
| 103. b | 104. d | 105. b | 106. a | 107. d | 108. d | 109. c | 110. c | 111. b | 112. b | 113. d |
| 114. a | 115. a | 116. a | 117. d | 118. d | 119. b | 120. d | | | | |