Computer Network And Telecommunication

Data communication
The process of transferring data or information between computers called data communication.

Telecommunication
It refer all types of data transmission like characters, numerical, photos, audios and videos etc using electronic or light emitting media. Eg email, voice mail, yideo conference etc

Cables (Guided Media)
Cables are the most common transmission media. Two or more devices are connected directly using cables. Three types of cables are used in computer networking they are:

Twisted pair cable
Twisted copper cables are used only for lower bandwidth. It consists of two isolated strands of copper wire twisted around each other. There are two types of twisted pair cables they are as follows:

UTP (Unshielded Twisted Pair)
UTP cables does not have metal shield expect plastic coating. It contains number of twisted pairs of wires with a simple plastic casing. It commonly used to for LAN and Telephony. It is cheaper and easier to work with, but do not offer high bandwidth and good protection from interferences. It can support data transmission rates from 10 to 100 mbps.

STP (Shielded Twisted Pair)
STP is similar to UTP but it is shielded with metal sheath along with plastic coating. It offers high bandwidth and good protection from interferences. It is cheaper than fiber optic cable. It can support data transmission rates from 10 to 500 mbps.

Co- axial cable
A co-axial carries higher bandwidth than twisted pair, it is easy to connect. It does not bend readily. This cable consists of one or more small cables in a protective covering. It offer very high data transfer rate and can be placed underground and laid on the floors of lakes and oceans.

Fiber Optic cable
Fiber optic cable is a thin filament of glass fiver wrapped in a protective jacket. It consists of strands of glass like thread, each about the diameter of a human hair. It offer high-speed data transmission rate because data travel as high-speed pulses of light.

Wireless (Unguided Media)
It is used to transfer data with in a large geographical areas or globally without the use

of interconnecting wires or cables. It uses other components such as radio signals, microwaves, or infrared to connect network.

Types of wireless communication

Microwave System

Microwave signals are similar to radio and television signals and are used to transmit data through the space without the use of cable. It provides high-speed data transmission. These signals cannot bend or pass obstacles like hills and tall buildings, so very high towers are used to mount the signals. The transmission is limited about 30 miles. Chain of towers is required to transmit the microwave signals in a long distance

Satellite communication

Both microwaves signals and telephone signals can be relayed to a earth station for transmission to a communication satellite. The earth station consists of a satellite dish that functions as an antenna a communication equipment to transmit and receive data from satellite passing overhead. It is not disturbed by hills and tall buildings and visible from any point. So sender and receiver easily communicate with each other using antenna by aiming the satellite. It is very expensive for placing satellite along the earth orbit.

Modulation

The process of changing some characteristics (amplitude, frequency or phase) of carrier wave in accordance with the intensity of the signal is known as modulation.
Types of modulation

- Amplitude Modulation (AM)
- Frequency Modulation (FM)
- Phase Modulation (PM)

Mode of communication

Simplex mode

Simplex is one-way data transmission that takes place only from sender to receiver. An example of this would be a television that allows the signal to pass in only one direction. Computer network connections do not use simplex.

Duplex mode

Duplex is two-way data transmission that takes place both directions over a communication channel. Computer use duplex channel. For example if computer A and computer B are connected together than both computer can share data or information. From computer A to computer B or computer B to computer A.

Types of Duplex Mode

Half duplex

Half duplex is two way data transmission that takes place in only one direction at a time. Eg walkie Talkie

Full duplex

Full duplex is two-way data transmission that takes place in both directions at a time. Eg mobile communication, voice call, video-conferencing etc.

Computer Network
A computer network is a logical or physical interconnection between two or more computers such that they could communicate with each other. It is used to provide users with the access to share resources. These shared resources include data files, application software and hardware.

Components of computer network.

- Computer
- Transmission media
- Network software.
- Protocols.
- Networking cables(Transmission media)

Advantages of computer network:

- Resources, data, software and hardware can be shared.
- Faster & cheaper communication and data transmission.
- It provides as the tools for e-mail teleconferencing videoconferencing which facilities communication.
- Flexible working condition.
- Office automation can be making very effective well managed.

Disadvantages of computer network.

- High installation and administrative cost.
- Attack on the privacy of the people.
- Computer virus spread most easily through network.
- Technologically very complicated.
- If the server is out of order, then all workstations are hang up.
- Well trained technical support is required.

Network architectures or (Types of Network Architecture) or LAN Architecture:

Client server Network Architecture
This is old model of computer network. In this kind of network model one main

computer equipped with very powerful processor, large memory and network operating system works as a main computer or service provider. Other computers connected with server, which are also called workstation or node or terminals can use the hardware and software resources of server computer. There are different types of server such as file server, print server, network server or email server.

Advantages of client server network:

- It works with any size or physical layout of LAN.
- It does not tend to slow down with heavy use.
- The network can be expanded to any size as we wish.
- It provide very high level security
- It reduces software installation time and cost to all computers.

Disadvantages of client server network:

- It is very difficult to setup and well trained technicians are required to handle and setup.
- It is expensive compare to peer to peer network.
- All software and operating systems are installed in server computer so that other client computer has to depend on it.

Peer to peer Network Model

It is also called workgroups also. Because all computers in the network have equal responsibilities. All computers in the network have access to at least on e or more computers. It mostly used in LAN and every organizations, research centers such as banks, travel agencies, airlines educational institutions etc.

Advantages of peer to peer network:

- It is easy to setup.
- Users in each computer can determine the resources to be shared among other computers.
- Any required software can be installed on individual computers , they don’t have to depend on the server.
- It is suitable at home, office, banks and small organization.
- It is cheaper compare to client server network.

Disadvantages of peer to peer network:

- It is slow because of heavy load.
- It is suitable for limited area such as school offices and small organization.
- The network expansion is limited and can not be expanded as the wish.

- It has limited security level.

Types of computer network on the basis of geographical area
Local Area Network(LAN)
The way of connecting two or more computers in a very limited area (about 100 to 300 meters) or within a same building or a group of adjacent building is called LAN. It enables very high speed communication through wire connection or wireless connection some times. Small organizations prefer it because of less expensive and faster communication.

Metropolitan Area Network(MAN)
The way of connecting computers inside a metropolitan area is called MAN. The area may be a part of city, whole part of city, district, zone or country. Radio wave is used to transmit the data for communication between the workstation and server in the system. Many different systems of networking and computing are brought together to form a MAN.

Wide Area Network(Wide Area Network)
The connection of computers of networks covering more distance or the world by the help of wave, frequency and satellite is called WAN or Internet. Different types of LAN and MAN are connected to form a WAN. It covers more area but it is slower than LAN and MAN.

Network Topology
The physical structure of network is called topology. It may contain software, hardware or geographical situation of the networking. Or in another words it is the pattern in which the computers are interconnected.

Types of Network Topology

BUS Topology
Uses a single length of cable to interconnect network devices. Uses terminators to dampen signal reflection at the ends of the cables
Advantages of Bus topology

- Since each small segments of cables are joined to form a trunk or network bus it is easy to setup computers on the bus.
- Since nodes are arranged in the linear form, it requires the less amount of cables.
- The coaxial cables used for networking are inexpensive and joining connectors on the cables is also easy.
- The position of server computer can be any where on the bus topology.
- Failure of any node does not affect other nodes on the network. f. Well suited for temporary networks (quick setup)

Disadvantages of Bus topology

- If the backbone cable i.e. network bus has problem then the entire network fails.
- Finding fault on this topology is not easy.
- It provides limited flexibility for change, so adding or removing nodes in between is not easy.
- The performance degrades when the number of computers is more on the network. So, it is not suitable for big size network.

Ring Topology:
Devices are connected in a ring formation. It support very high data transmission rate

Advantages of Ring Topology

- Since each node on the ring acts as a repeater, no any external repeater is required to boost up the signals.
- It supports high data transmission rate.
- It is easy to setup.

Disadvantages of Ring Topology

- If any node or connecting cable fails the entire network does not work.
- The diagnosis of the fault is difficult.
- Since data or message reaches on the node in sequence, so addition of new nodes increases the communication delays.
- It provides limited flexibility for change, so adding or removing nodes in between is not easy.

Star Topology:
Most commonly implemented network topology used today that uses centrally located device i.e hub or switch is known as Star Topology.
Advantages of star network

- Computers can be added or removed easily without affecting the network.
- If any of the workstation or the connecting cable fails, it does not affect the remaining portion of the network.
- Fault detection in the star topology is easy.
- It is easy to extend so it is suitable for a large network.
- It is one of the most reliable network topology.

Disadvantage of Star Topology

- Since each node is required to connect with the centralized hub or switch more cables are needed which increases the cost of installation.
- The entire network fails if there is any problem on the hub or switch.
- In comparison to Linear and Ring topologies, t is little expensive as it requires more length of cables and other controlling devices.

Different devices and terms used in Network:

MODEM

Modem is a device that directly converts digital signal from a computer or other digital devices into analog form for transmission over analog link i.e telephone line and vice versa. MODEM stands for Modulation and Demodulation. There are two types of modem used in computer they are as follows:
Internal modem and External modem.

NIC

It is a Network Interface Card, which connects each computer to the wiring to the network. A NIC is a circuit board that fits in one of the computer's expansion slots. It provides a port on the back of the computer to connect in the network.

Hub

Hubs are connectivity devices, which contain multiple ports for connecting to network components. Hubs connect the computers in a star topology. It lies between server and clients computers.
Connector : Bridge and Gateway are the two different connectors, which play role to link between two network systems.

Bridge

Bridge connects networks using same communications protocols or similar networks so that information can be passed from one to the other.
Gateway
Gateway connects networks using different communications protocols or dissimilar networks so that information can be passed from one to the other.

Switch

A device that capable of forwarding packets directly to the ports associated with particular network addresses. Hubs and switches are almost same but switch is new technology and intelligent compare to hub.

Repeater

A device used on communications circuits that decrees distortion by amplifying or regenerating a signals so that it can be transmitted onward in its original strength and form as they pass through a network cable.

Protocols
Protocols are the set of rules and formats for sending and receiving data. It works as guidelines to govern the exchange between equipments. There are different types of protocols that we can use. Some of popular protocols are TCP/IP, HTTP, FTP, IPX/SPX.

Router
A router is a device that is used to connect different LAN in the network. It receives transmitted messages and forwards them their correct destinations over most efficient available route.

NOS(Network Operating System)
The operating, which can support network environment, is called Network Operating System. For example Windows XP, 2000, server, unix, linux, Novel Netware etc.

Network Protocol(Communication Protocol)
A set of rules by which computers on the network communicate with each other is known as network protocol. The common protocols used on the network are:
TCP/IP (Transmission Control Protocol / Internet Protocol)
SMTP (Simple Mail Transfer Protocol)
FTP (File Transfer Protocol)
HTTP (HyperText Transfer Protocol)
POP (Post Office Protocol)
IPX/SPX (Internet Packet Exchange/Sequential Packet Exchange)
NetBEUI (NetBIOS Extended user interface)
AppleTalk
VOIP(Voice Over Internet Protocol)
HTTPs (HyperText Transfer Protocol Secured)
UDP(User Datagram Protocol)

Internet and its Services

The Internet is the interconnection of millions of computers across word wide in order to share data and information. It is the largest network formed by connecting computers on LANs, MANs and WANs of the whole world through the TCP/IP protocol to share data and information.

The services provided by the Internet to the client computers are WWW, E-mail, Chat , E-Fax, Video Conference, E-commerce , File transferring , Telnet, Newsgroup, tele-medicine, social network service, e-learning and so on.

The components required to use internet in a computer are Web Browser , Internet Account (ISP), Router, telephone line, cable internet line, optical fiber etc. A web browser is the essential software required for browsing or surfing web sites on the internet.Google Chrome, Netscape Navigator, Microsoft Internet Explorer and Mozilla FireFox are the popular web browsers. An ISP (Internet Service Provider) provides facility of the internet to the users. The local ISP connects a computer to the internet. World Link, ADSL, Vianet, Web Surfer, Otel, Subisu are the popular local ISPs of Nepal.

Intranet : It is a private network owned by a company or an organization with limited users, limited services and limited area to share data and information.

Computer Virus

Computer virus is a malicious, destructive and self-replicating computer program that disrupts the normal functioning of the computer system. Computer viruses can transfer from one computer to another through different sources to a computer without the knowledge and permission of the user and they are capable for hiding themselves in other files.

Route of transmissions of Computer Virus are
Sharing of infected external portable hard disk, pen drive or CDs and DVDs.
Using pirated software (Illegal software).
Opening of virus infected e-mail messages and attached file.
By downloading files or programs from the web sites which are not secured.
By exchanging of data, information or files over a network.
Browsing untrusted sites.

Symptoms of Computer Virus
Programs take more time to load, fail to load or hang frequently.
Unexpected messages or images appear suddenly on the screen.
Missing of files or appearing of unexpected files.
Displays unusual error messages or encounters errors frequently.
Displays low memory message frequently.
Programs open automatically without giving instruction.

Types of Computer Viruses
Boot Sector Infector Virus
File Infector or Parasitic Virus
Multipartite Virus (Both features of Boot Sector and File Infector virus)
Macro Virus
Script Virus

Anti-Virus
Antivirus is a constructive program that detects and eliminates viruses from computer. Some popular antivirus are Kaspersky Anti-virus, Avira Antivirus, Norton Antivirus (NAV) , McAfee Antivirus, Panda Anti-Virus, AVG Anti-Virus etc.

Computer Security

The securing computer data, information, software and hardware from being damaged or lost due to accidental or intentional is known as Computer Security.

Types of Computer Security

1. Hardware Security Measures

- Regular Maintenance
- Insurance
- Free from dust environment
- Protection from fire
- Protection from theft
- Using Air condition system
- Using Power Protection devices (UPS, Spike guard, CVT, Voltage Stabilizer)

2. Software Security Measures

- Using Password Policy
- Using Antivirus Software
- Using Backup
- Scandisk utility
- Defragmentation

Cyber Law and Computer Ethics

The cyber law is formulated in order to legalize the electronic transaction through electronic media, to control the various types of electronic frauds , to punish a person who does criminal activities through electronic means especially computer, to promote e-commerce and e-governance.

Cyber Law of Nepal

Cyber Law of Nepal was introduced on 30th Bhadra, 2061 (15 September, 2004) in order to legalize the electronic transaction and to control cybercrimes.

Computer Ethics

It is a code of conduct or set of rules and regulation that should be followed by each and every computer users while using computer or electronic media i.e Internet.

Computer Ethics are

We should not use a computer to harm other people.
We should not use or destroy other's files or database.
We should not use computer to publish fake information.
We should not copy or make duplicate copy and distribute illegally.
We should not steal computer password of others or use it.
We should not use other people's computer resources without permission.
We should not steal or use digital signature and pin of ATM card of others.
We should not create a virus and use it.
We should not publics an illegal pictures or videos in electronic form.

Multimedia and its Applications

Multimedia is technology for presenting the information in more attractive, interesting, interactive and understandable manner with the help of different media like text, pictures, videos, sounds, and animations.
Components of Multimedia

- Text
- Audio
- Video
- Animation
- Sound

Application of Multimedia Technology

- Multimedia in education
- Multimedia in Business
- Multimedia in Internet
- Multimedia in Animated movies
- Multimedia in Video games
- Multimedia in industries

Advantages of Multimedia

- It is used to present ideas, information to others in effective ways.
- It is used in smart class for teaching different subjects in interesting, and effective ways.
- Student can learn, read and test his/her knowledge using multimedia technology.
- It is used in animated Games and movies to make more realistic.
- It is used in Electronic advertising to present the information.

Disadvantages of Multimedia

- The cost of developing a multimedia product is high.
- An ordinary computer doesn't support multimedia.
- The Skill manpower is required to operate multimedia.
- It is an expensive technology

Database and DBMS (MS-ACCESS)

Data: It is the collection of facts and figures collected from different like questionaries' and queries. Data are information to the computer which are processed to get desired result and are the piece of information.

Information: The data which gives meaning or suitably arranged for communicating interpretation, and processed by human being by automated means such as computer is called information.

Database
A database is a collection of data that is organized so that its contents can easily be accessed, managed and updated. Examples of database system are
Banking software
Airlines systems
University systems
Telecommunication systems
Finance
Sales
Manufacturing
Human resources

File
A file is a collection of electronic information store in computer.
Record: A record is a information about an element such as a person, animal, students, place etc.

DBMS
A database management system (DBMS) is a computer program designed to manage a database (a large set of data), and run operations on the data requested by clients. For example Oracle, Microsoft Access, Ms. SQl, MySQl, dBASE, dBase, FoxPro, SYSBASE etc. are the well-known database management system.

RDBMS
Relational Database Management System (RDBMS) is method of viewing information from several, separate database that relate to one another through the keyword or values. The main advantage of RDBMS is that we can simultaneously use more than one database to see information stored in them.

Importance of database:

- Database stores the data.
- Computerized database saves data from being lost.
- Computerized database protects from unauthorized access and use of the data.
- Data can be stored in a small area or space in computerized database.

Features of DBMS:

- Easy to access data.
- Ease to modify data.
- Delete existing data.
- Organize the data in proper sequence.
- Sorting and indexing of data.
- Easy queries in data.
- Retrieve the data easily.
- Print the formatted reports, labels etc.
- Linking between two or more databases.
- It can be used as SQl (Structured Query Language)

Microsoft Access
It is a RDBMS software.

Features of Microsoft Access:

- It provides very useful database features such as tables, forms, reports and queries.
- It works as front end development tool.
- This provides end-user applications developer environment.
- It shares data with other application such as Microsoft Word or Excel.
- It support three computer programming language such as: SQL, Macros and Visual BASIC etc.

Objects of MS Access
Table
A table is collection of data about a specific topic, such as products or suppliers. Using a separate table for each topic means that you store that data only once, which makes your database more efficient, and reduces data entry errors.
Table is the primary object of Ms Access. A table stores data in tabular form. A table is made up of rows and columns.

Some parts of table are as follows:
Fields (column): The title name of the column that holds data is known as field. A table can have many fields.
Records (rows): The collection of data horizontally for each field is known as record. A record is complete information about an entity.
Data: The actual information stored under a filed title in a row is called data.
Index: A table can have index attached with it. The index is used to keep the data in organized for and helps faster retrieval of data.
Primary key: A primary key is a field which is uniquely identified. All the records of a

table are uniquely identified on the basis of primary key. The column that has been defined as the primary key can't hold null value. For example a student's roll no. can be defined as primary i.e can't be null and repeat.
Compound key: The primary key based on more than one field is known as composite key. It consists of multiple columns, because one column is not sufficiently unique.
Foreign key: Foreign key is the linking pin between two tables. It shows the relation between any two tables.

Queries
A query is an object of MS-Access which is used to retrieve records from database,search or question that you make for a record or item. The record is stored in the database file. Queries help to investigate about data records.

Forms
Forms present the data from a table or a query in a way we want it to be displayed. The fields in the table or query are made available to place on the forms we create. Uses of form.

- Displaying and editing data.
- Controlling application flow.
- Accepting input.
- Displaying messages.
- Printing information.

Reports
Reports are the printed results of data processing. Reports are specially formatted collections of data, organized according to your specification for summarizing and printing listings of database data. While forms are designed to be used onscreen, reports are designed to be viewed and printed.
Relationship: In a database we can establish relation between any two or more tables. Because no data are isolated, but they are associated or related with each other entity in one or another ways. we can generate reports and manipulate data using such relationship between tables.

Data Type of Ms Access
Data type defines the nature of the data to be stored in the column. Access provided different types if data that can be stored.

- Text : (Default) Text or combination of text and numbers, up to 255 characters.
- Memo : Use for lengthy text and numbers, such as notes or descriptions. Stores up to 65,536 characters.
- Number: Use for data to be included in mathematical calculations.
- Date/Time: Use for dates and times . It occupies 8 Bytes.

- AutoNumber :Use for unique sequential (incrementing by 1) or random numbers that are automatically inserted when a record is added.
- Yes/No :Use for data that can be only one of two possible values, such as Yes/No, True/False, On/Off. Null values are not allowed.
- OLE Object :Use for OLE objects (such as Microsoft Word documents, Microsoft Excel spreadsheets, pictures, sounds, videos or other binary data) that were created in other programs using the OLE protocol.
- Hyperlink : Text or combination of text and numbers stored as a text and used as a hyperlink.
- Lookup Wizard Use to create a field that allows you to choose a value from another table or from a list of values using a combo box— -choosing this option in the data type list starts a wizard to define this for you.
- Currency : To store monetary value. It occupies 8 Bytes memory.

Field Properties:

- Format: It allows choosing different format of data type available.
- Caption: It used to display alternative name for the field to make the field name more explanatory. It can contain up to 2,048 characters.
- Default Value: Default value is the one that enter automatically in the database and can be changed as per required.
- Validation Rule: It is used to set the limitation while entering data in the database. It helps us to customize the data entry and checks for error entry of data.
- Validation Text: If wrong data is entered which do not supported by given validation rule, it is used to display messages on the screen and work as a precaution of wrong data entry.
- Required: If required is set as Yes then field should always receive a value during data entry.
- Indexed: You can choose whether you want to index the table. The available index options are unique index and duplicate index.
- Input Mask: It is usually used to set control the data entry in the database. Using this option we can customize the data entry by setting special commands using the following symbols:
- Field size property is set to the maximum size for data stored in the field set to the text or number data type. For next data, the default field size is 50 and maximum size is depending on the type of data types.

Data Sorting

The process of arranging the data of table either in ascending or descending order is known as data sorting.

Review of Control Statements in QBASIC

IF Statements in QBASIC

1.IF …. THEN Statement

IF THEN Statement

Or,

```
IF THEN
    Block of statements
END IF
```

Where, condition is a logical expression that evaluates either true or false.

2. IF….. THEN….. ELSE Statement

Syntax:

```
IF THEN
    Statement1
ELSE
    Statement2
END IF
```

3. IF….. THEN….. ELSEIF….. ELSE Statement

Sytanx:

```
IF THEN
    Statement1
ELSEIF THEN
    Statement2
ELSEIF THEN
    Statement3
    …….
    …….
    ……
    …….
ELSE
    Statement_N
END IF
```

```
REM find the greatest number among any 10 numbers.
CLS
FOR j=1 TO 10
    INPUT "Enter a number";n
    IF n>g THEN g=n
END IF
```

```
PRINT "The largest number is "; g
END
```

```
REM finds the middle number among any three numbers.
CLS
INPUT "Enter any three numbers"; a, b, c
IF (a>b AND ac) THEN
    PRINT a; " is the middle number."
IF (b>c AND ba) THEN
    PRINT b; " is the middle number."
ELSEIF (c>a AND cb) THEN
    PRINT c; "is the middle number."
END IF
END
```

SELECT CASE Statement

Syntax:

```
SELECT CASE testexpression
CASE expressionlist-1
    [Statements Block-1]
[CASE expressionlist-2
    [Statements Block-2]]
    ……
    …….
    ……
    …….
[CASE ELSE
    [Statements Block-N]]
END SELECT
```

```
REM counts total number of vowels and consonants in a word.
CLS
INPUT "Enter a word"; W$
R$= UCASE$(W$)
FOR K= 1 TO LEN(R$)
    E$= MID$(R$, K, 1)
    SELECT CASE E$

    CASE "A", "E", "I", "O", "U"
        x=x+1
    CASE ELSE
        y=y+1
    END SELECT
```

```
NEXT K
PRINT “The number of vowels in the word :”;x
PRINT “The number of consonants in the word:”; y
END
```

Loops in QBASIC

The repetition of the statement block time and again till the condition is satisfied is known as loop. The looping statements supported by QBASIC program are

1. For Next Loop

Syntax:

```
FOR Variable = start TO end STEP (increment/decrement)
    [Block of statements]
NEXT Variable
```

```
REM displays first 10 even numbers and sum of those even numbers.
CLS
N=2
FOR P = 1 TO 10
    PRINT N;
    S=S+ N
    N = N + 2
NEXT P
PRINT “Sum of the first ten even numbers:”;S
END
```

2. WHILE …. WEND Loop

Syntax:

```
WHILE
    [Statements block]
WEND
```

3. DO…LOOP

Syntax-I (Entry Control Loop Structure):

```
DO WHILE|UNTIL
    [Statements block]
LOOP
```

Syntax-II (Exit Control Loop Structure):

```
DO
    [Statements block]
LOOP WHILE|UNTIL
```

Where, Condition is the logical expression that evaluates as true or false.

```
REM Sum  of digits of an integer
CLS
INPUT “Enter an integer”; N
DO
        R = N MOD 10
        S =S+ R
        N=INT(N/10)
LOOP WHILE N<>0
PRINT “Sum of digits”; S
END
```

```
REM Sum  of digits of an integer
CLS
INPUT “Enter an integer”; N
DO
        R = N MOD 10
        S =S+ R
        N=INT(N/10)
LOOP UNTIL N=0
PRINT “Sum of digits”; S
END
```

Nested Loop

The loop inside a loop is called nested loop.

Syntax:

```
FOR Variable1 = start TO final STEP (Increment or Decrement)
FOR Variable2 = start TO final STEP (Increment or Decrement)
        [Statements block]
NEXT Variable2
NEXT Variable1
```

```
CLS
FOR j= 1 TO 5
FOR k = 1 TO j
        PRINT k;
NEXT k
PRINT
NEXT j
END
```

Review of Library Function

A function in QBASIC is a readymade small program or user made small program that can perform a specific task. The function manipulates the data passes to it and returns either a string or a numeric value. QBASIC supports two different kinds of functions.

i. User Defined Function
ii. Library Function

User Defined function is created by a user using function procedure to perform certain task which can't perform by using library functions.

Library function is also known as Built-In function or Routine function. A library function in QBASIC may be string function or numeric function. A string library function can manipulate either string or numeric data and returns a string value. A function name having dollar sign ($) is string function. LEFT$(), Right$(), CHR$(), STR$( ), UCASE$( ), DATE$ ( ), MID$(), DATE$(), TIME$(), SPACE$(), LTRIM$(), RTRIM$(), INPUT$(), etc. are some example string functions. A numeric function can manipulate either string or numeric data and returns a numeric value. A numeric library function name has no type declaration sign. CINT(), SQR(), ASC(), VAL(), LEN (), SGN( ),ABS( ), SIN( ), TAN( ), COS() etc. are some example of numeric library functions.

REM converts uppercase letters of a word in lowercase and vice versa.

```
CLS
INPUT "Enter a word"; W$
FOR k = 1 TO LEN (W$)
        E$= MID$(W$, k, 1)
        IF E$=UCASE$(E$) THEN
                New$ =New$+ LCASE$(E$)
        ELSE
                New$ =New$+ UCASE$(E$)
        END IF
NEXT k
PRINT "New word after converting case is :"; New$
END
```

REM removes vowels characters from the supplied word.

```
CLS INPUT "Enter a word:"; W$
FOR j= 1 TO LEN(W$)
        E$= UCASE$(MID$(W$, j, 1)
        IF E$<>"A" AND E$<>"E" AND E$<>"I" AND E$<>"O" AND E$<>"U"
THEN
                New$=New$+E$
        END IF
```

```
NEXT j
PRINT "New word is :"; New$
END
```

REM to check palindrome word.

```
CLS
INPUT "Enter a word"; W$
FOR j= LEN (W$) TO 1 STEP-1
        rev$= rev$+MID$(W$, j, 1)
NEXT P
IF W$=rev$ THEN
        PRINT "Palindrome word"
ELSE
        PRINT "Not palindrome word"
END IF
END
```

REM converts Decimal number into Binary Number.

```
CLS
INPUT "Enter a Decimal number"; N
M = N
DO WHILE N<> 0
        R= N MOD 2
        B$=STR$(R) + B$
        N= INT(N/2)
LOOP
Ans=VAL(B$)
PRINT "Binary equivalent of entered number is "; Ans
END
```

Modular Programming in QBASIC

The programming technique, in which a large and complex program is divided into small logical and manageable part of the program which can perform specific task, is known as modular programming. The small, logical and manageable part of the program is called procedure (module). Since the modular programming uses small block of functional codes, it is also called structured program.

Advantages of modular programming

- A procedure can be reused in a program which reduces the length of the program.
- It is suitable for a team work so that task can be divided with a team members.
- The debugging of the program becomes easier and faster since they are divided into different modules.
- The procedure can be tested and debugged separately.
- The documentation of an individual procedure is simpler as compared to the documentation of a large and complex program.

Types of procedure

1. Sub Procedure

A Sub procedure is a small, logical and manageable functional part of a program which performs the specific tasks and does not return any value to the main module. A sub procedure can call another sub procedure in the program. A sub procedure is called by using CALL statement. When a sub procedure is called the program control transfers from the main module to the sub module and the execution of the codes in the sub module takes place. After the completion of execution of its codes the program control returns to the next statement of the calling module i.e. after the CALL statement.

2. Function procedure

A Function procedure is a small, logical and functional part of a program which performs the specific tasks and it returns a single value to the main module or calling module. The returned value of the function procedure may be string or number. So, there are two types of user defined functions. They are String Function and Numeric Function. Once the function procedures are defined in the program they can be used in the program. To use the function procedures in a program, the procedure needs to be called from the main module. The PRINT Statement or a variable is used to call the function procedure.

```
REM to display volume of cylinder
DECLARE SUB Volume ( r, h)
CLS
CONST pi=22/7
```

```
INPUT “Enter radius of a cylinder”; r
INPUT “Enter height of the cylinder”;h
CALL Volume (r, h)
END

SUB Volume (r, h)
        v = pi*r^2*h
        PRINT “Volume of the cylinder =”; v
END SUB

REM checks whether input integer is prime or composite.
DECLARE FUCNTION PRIME$(N)
INTPUT “Enter an integer”; N
PRINT “The number is  :” PRIME$(N)
END
FUNCTION PRIME$(N)
FOR P= 1 TO N
        IF N MOD P = 0 THEN C= C + 1
NEXT P
IF C=2 THEN
        PRIME$= “Prime”
ELSE
        PRIME$=”Composite”
END IF
END FUNCTION

REM to display longest student name among any ten names
DECLARE FUNCTION Longest$(n$( ))
CLS
DIM n$(10)
FOR P= 1 TO 10
        INPUT “Enter student name”;n$(P)
NEXT P
PRINT “The longest student name is “; Longest$(n$( ) )
END

Function Longest$(n$())
long$= n$(1)
FOR P = 2 TO 10
        IF LEN (n$(P))>LEN (l$) THEN long$= n$(P)
```

```
NEXT P
Longest$= long$
END FUNCTION
```

REM to display the number in an ascending order using an array with sub procedure.

```
DECLARE SUB SORT ( N( ) )
CLS
DIM N(10)
PRINT "Enter ten different numbers:"
FOR P= 1 TO 10
        INPUT N (P)
NEX P
CALL SORT (N ( ))
END
```

```
SUB SORT (N ( ))
FOR P= 1 TO 9
        FOR Q = 1 TO 10-P
                IF N (Q)>N (Q+1) THEN SWAP N (Q), N (Q+1)
        NEXT Q
NEXT P
PRINT "Numbers are in ascending order:"
FOR P = 1 TO 10
        PRINT N (P)
NEXT P
END SUB
```

REM uses of global variable

```
DECLARE SUB Average ( )
COMMON SHARED a,b,c
CLS
INPUT "Enter three numbers "; a,b,c
CALL Average
END
```

```
SUB Average
        Avg=(a+b+c)/3
        PRINT "average= ";Avg
END SUB
```

Note: In the above program a,b,c are global variables and Avg is a local variable.

File handling in QBASIC

Program file

A program file has a set of instructions and codes which are needed for data processing. It has .BAS as an extension.

Data file

A data file has collection of related data stored in a secondary storage device of computer. Such a collection of data in a row is known as a record. A record in a data file contains the detailed information of a person or anything. For example, a record of a data file related to 'employee' consists of employee name, post, department, date of birth and salary. A field is a particular data of a record.

Types of data file

1. Sequential Access File

Sequential access file, data is stored in sequential order. The data of a sequential access file can only be accessed sequentially. For example, if a sequential access data file has stored name of a person, address and age of some people then data of this file need to access in the same order as the data are stored in a row. Since the accessing of data from the sequential data file is done in sequential order, the accessing data takes long time if the data file contains large records.

2. Random access data file

A random access file allows us to write or read data from any location of the file. We can read or write any record directly in a random file without searching through all the records that precede it. Thus, reading and writing of data is faster than sequential access data file.

How to open a sequential data file?

OPEN statement is used to open a sequential data file.
Syntax 1: OPEN FOR AS # Filenumber
Where,
Filename is the name of the sequential data file.
Mode determines the operation of data file like OUTPUT, INPUT and APPEND. The different modes and their purposes are listed below.

OUTPUT mode

To create a new sequential data file and store data in it.

INPUT mode

To retrieve the contents of the existing data file.

APPEND mode

To add more records in the existing data file.
File number is a number from 1 to 255 that identifies the data file.

```
REM to create a new sequential data file and to store data.
CLS
OPEN "employee.dat" FOR OUTPUT AS # 1
DO
    INPUT "Enter employee name ";n$
    INPUT "Enter address"; a$
    INPUT "Enter post";p$
    INPUT "Enter salary"; sal
    WRITE#1, n$,a$,p$,sal
    INPUT "Do you need more records (y/n)"; ch$
LOOP WHILE UCASE$(ch$) = "Y"
CLOSE#1
END
```

```
REM to display the content of datafile
CLS
OPEN "employee.dat" FOR INPUT AS # 1
PRINT "Name", "Address", "Post", "Salary"
WHILE NOT EOF (1)
    INPUT#1, n$,a$,p$,sal
    PRINT n$,a$,p$,sal
WEND
CLOSE#1
END
```

```
REM add more records to the data file
CLS
OPEN "employee.dat" FOR APPEND AS # 1
DO
    INPUT "Enter employee name ";n$
    INPUT "Enter address"; a$
    INPUT "Enter post";p$
    INPUT "Enter salary"; sal
    WRITE#1, n$,a$,p$,sal
    INPUT "Do you need more records (y/n)"; ch$
LOOP WHILE UCASE$(ch$) = "Y"
CLOSE#1
END
```

An introduction to C Language

C is a high level programming language developed at AT & T's (American Telegraph and Telephone) Bell Laboratories of USA in 1972. It was designed and written by a man named Dennis Ritchie. In the late seventies C began to replace the more familiar languages of that time like PL/I, ALGOL. It is general purpose high level programming language, which is used to develop business programs, text processing programs, database management programs and even to develop Operating System (OS). It is also known as structured programming language.
Structured Programming is a programming methodology that produces programs with clean flow, clear design, and a degree of modularity or hierarchical structure. Benefits of structured programming include ease of maintenance and ease of readability by other programmers.

Advantages of structured programming language

- A large and complex program can be divided into several simpler and manageable sub modules.
- Support simultaneously coding of modules by multiple programmers at a time.
- Modules and functions once built here can be used in other programs.
- It reduced testing and debugging time.
- The program can be easily modified.
- It is portable and occupies less memory space in computer.

Features/Characteristics of C language

- It is structured programming language.
- It is general purpose programming language.
- It contains rich and powerful set of operators.
- It contains rich and powerful set of declaration and data types.
- It allows manipulation of internal process registers.
- It is a middle level programming language that supports both high and low level programming languages. So, it is used to develop system software and application software.

Similarities in QBASIC and C language

- Both languages can be used to develop structured programs.
- Both languages support local and global variables.
- Both languages support procedures.

Differences between QBASIC and C language

- QBASIC is high level language whereas C language is a middle level language.
- QBASIC supports both sub procedure and function procedure whereas C language supports only function procedure.
- QBASIC is basically used for developing application software whereas C language is used to develop system software and application software.

Basic elements of C language are listed below

i. C Language character set

The C character set is a set of characters which are allowed to represent information in C language. The C character set consists of the alphabets (both upper case and lower case), the digits (0-9) and certain special symbols (+ - * & ^ % $ # @ ! ? > < etc).

ii. Identifiers in C Language

In a C program every word is either classified as an identifier or a keyword. Identifiers are used to identify or name various program-elements such as variables, symbolic constants, functions, etc.

iii. keywords in C Language

Keywords are reserved words which have special meaning for the C compiler. Keywords are not allowed to use as identifiers. Keywords are also known as reserved words. There are 32 keywords in C. The keywords of C language are auto, double, int, struct, break, else, long, switch, case, enum, register, typedef, char, extern, return, union, const, float, short, unsigned, continue, for, signed, void, default, goto, sizeof, volatile, do, if, static, while.

iv. Data type in C Language

The data type in C language defines the amount of storage allocated to variables and the values that variables can accept. C language supports basic four data types. They are char, int, float and double.

The space occupies by int is 2 bytes, char is 1 byte, float is 4 bytes and double is 8 bytes.

Data type modifier

The keyword that modifies the size and range of the basic data types is known as Data Type Modifier. The modifiers define the amount of storage allocated to the variable. The C language uses four types of data type modifiers. They are signed, unsigned, long and short. The data type modifier changes the size and range of the data that can be stored in a variable.

v. Variables in C Language

In C language, you need to declare variables before you use them in a program. A variable declaration tells the compiler the name and type of a variable. If a program attempts to use a variable that has not been declared, the compiler generates an error message.

In C language to store a character, a Character variable is used, to store string, an array variable is used and to store numeric values, numeric variables like integer variables and floating point variables are used.

vi. Operators in C Language
An operator is a symbol that operates on a certain data type and manipulates them to produce the output. The operators used in C are listed below.

Arithmetic Operator
The arithmetic operator performs arithmetic operation on two operands. The following arithmetic operators are used in C +, -, /, *, % .

Unary Operators
A unary operator is an operator, which operates on one operand. The commonly used unary operators are increment (+ +) and decrement (- -) operators. The ++ operator increments the value of the variable by one, whereas the - - operator decrements the value of the variable by one. For example, x ++ is equivalent to x = x + 1 and x- - is equivalent to x = x-1.

Relational Operators
Relational operators compare two expressions and return result in term of True or False. The following relational operators are used in C language.
operators meaning expression <, <= , >= ,= = , ! = ,>

Logical Operators
A logical operator is used to combine relational expressions and returns the result either in True or False. The logical operators used in the C language are given below. &&, ||, !.

Assignment Operator
An assignment operator (=) is used to assign a constant or a value of one variable to another.

Conditional Operator
A conditional operator checks for an expression, which returns either a true or a false value.

Header files in C Language
A header file is a standard file that contains definitions of variables and functions necessary for the functioning of a program. A header file is included in a program by using '#include' directive. The header files in C language have .h extension. Some header files are listed below.

i. stdio.h
This is the standard input output header file that provides functions for performing

input and output operations. It contains the declarations of I/O functions like printf ( ), scanf( ), putchar(), getchar() etc.

ii. string.h

The string header file provides many functions useful for manipulating strings which contains the declarations of library functions like strrev(), strlwr(), strupr(), strchr ( ), strcmp( ), strlenr( ),etc.

iii. math.h

The math.h file is standard header file that handles mathematical functions like sqrt(), pow(), etc.

iv. ctype.h

The ctype.h header file contains declarations for character classification functions like isspace(), isupper(), tolower() etc.

Some C Language programs are given below

```
/* this program displays the product of  two numbers*/
#include<stdio.h>
#include<conio.h>
void main()
      {
      int a, b, p;
      clrscr();
      a = 20;
      b =16;
      p= (a * b);
      printf("product of  two numbers is %d", p);
      getch();
      }
```

```
/* to check whether an input number is even or odd */
#include<stdio.h>
#include<conio.h>
void main()
     {
     int n, r;
     clrscr();
     printf("Enter an integer");
     scanf("%d",&n);
     r = n% 2;
     if(r==0)
```

```
        printf (“%d is even number”,n);
else
        printf(“%d is odd number”,n);
getch();
}
```