Senior Secondary School

COMPUTER SCIENCE

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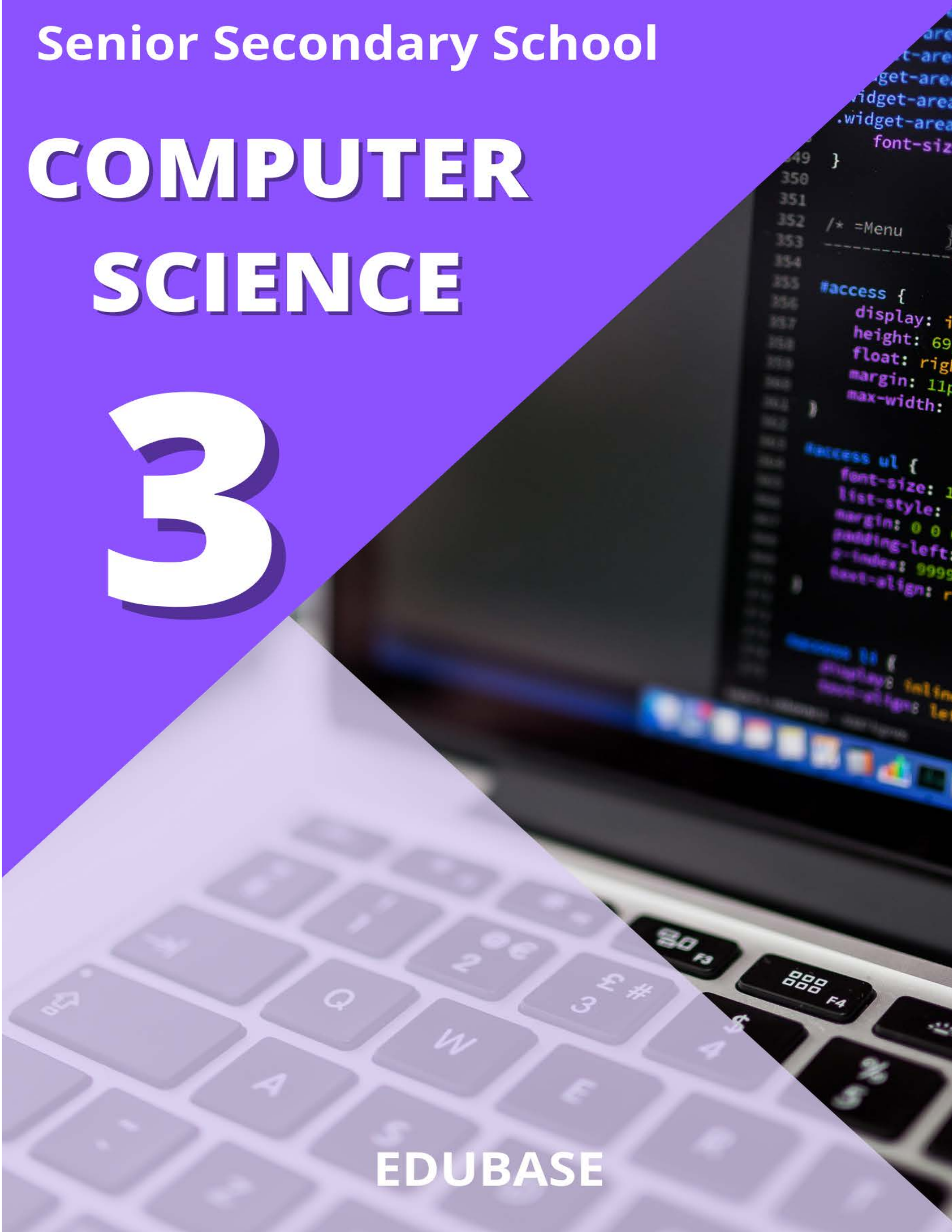

EDUBASE

SS 3
FIRST TERM
COMPUTER SCIENCE

TABLE OF CONTENT

FIRST TERM

WEEK 1

Computer Science SS3 First Term

Topic: Networking

Contents:

- **Definition of Networking**
- **Types of Networking**

Networking

Networking is the construction, design, and use of a network, including the physical (cabling, hub, bridge, switch, router, and so forth), the selection and use of telecommunication protocol and computer software for using and managing the network, and the establishment of operation policies and procedures related to the network.

A computer network can be defined as **a collection of interconnected computers in such a way that they share resources.** A computer system only referred to a group of the computers and hardware components interconnected by communicating channels that allow sharing of resources and information. It is the practice of interfacing two or more computing devices with each other for the purpose of sharing data. Computer networks are built with a combination of hardware and software. Technically, If at least one process in one computer can send or receive data to/from at least one process residing on a remote computer, then two machines are said to be a network.

A **computer network** is a set of connected computers. Computers on a network are called **nodes**. The connection between computers can be done via cabling, most commonly the Ethernet cable, or wirelessly through radio waves. Connected computers can share resources, like access to the Internet, printers, file servers, and others. A network is a multipurpose connection, which allows a single computer to do more.

It is this network that evolved to become what we now call the internet.

Networks are used to:

- Facilitate communication via email, video conferencing, instant messaging, etc.
- Enable multiple users to share a single hardware device like a printer or scanner
- Enable file sharing across the network
- Allow for the sharing of software or operating programs on remote systems
- Make information easier to access and maintain among network users

Types of Networks

There are many types of networks, including:

- Local Area Networks (LAN)
- Personal Area Networks (PAN)
- Home Area Networks (HAN)
- Wide Area Networks (WAN)
- Campus Networks
- Metropolitan Area Networks (MAN)
- Enterprise Private Networks
- Internetworks
- Backbone Networks (BBN)
- Global Area Networks (GAN)
- The Internet

There are several different types of computer networks. Computer networks can be characterized by their size as well as their purpose.

The size of a network can be expressed by the geographic area they occupy and the number of computers that are part of the network. Networks can cover anything from a handful of devices within a single room to millions of devices spread across the entire globe

Some of the different networks based on size are:

- Personal area network, or PAN
- Local area network, or LAN
- Metropolitan area network, or MAN
- Wide area network, or WAN

In terms of purpose, many networks can be considered general purpose, which means they are used for everything from sending files to a printer to accessing the Internet. Some types of networks, however, serve a very particular purpose. Some of the different networks based on their main purpose are:

- Storage area network, or SAN
- Enterprise private network, or EPN
- Virtual private network, or VPN

ASSESSMENT

1. Define networking
2. Define computer network
3. What are networks used for?
4. List 6 types of network
5. List the types of network based on their main purpose.
6. List the types of network based on their size.

WEEK 2

Computer Science SS3 First Term

Topic: Network Topology, Devices and Interface

Network topology is the arrangement of the various elements (links, nodes, etc.) of a communication network. Essentially, it is the topological structure of a network and may be depicted physically or logically. A network consists of multiple computers connected using some type of interface, each having one or more interface devices such as a Network Interface Card (NIC) and/or a serial device for PPP networking. Each computer is supported by network software that provides the server or client functionality. The hardware used to transmit data across the network is called the media. It may include copper cable, fiber optic, or wireless transmission. The standard cabling used for the purposes of this document is 10Base-T category 5 ethernet cable. This is twisted copper cabling which appears at the surface to look similar to TV coaxial cable. It is terminated on each end by a connector that looks much like a phone connector. Its maximum segment length is 100 meters.

Two basic categories of network topologies exist, physical topologies and logical topologies.

The cabling layout used to link devices is the physical topology of the network. This refers to the layout of cabling, the locations of nodes, and the interconnections between the nodes and the cabling. The physical topology of a network is determined by the capabilities of the network access devices and media, the level of control or fault tolerance desired, and the cost associated with cabling or telecommunications circuits.

In contrast, logical topology is the way that the signals act on the network media, or the way that the data passes through the network from one device to the next without regard to the physical interconnection of the devices. A network's logical topology is not necessarily the same as its physical topology. For example, the original twisted pair Ethernet using repeater hubs was a logical bus topology carried on a physical star topology. Token ring is a logical ring topology, but is wired as a physical star from the media access unit. Logical topologies are often closely

associated with media access control methods and protocols. Some networks are able to dynamically change their logical topology through configuration changes to their routers and switches.

Types of Network Connections

Computer networks can be broken down historically into **topologies**, which is a technique of connecting computers. The most common topology today is a **collapsed ring**. This is due to the success of a network protocol called the Ethernet. This protocol, or network language, supports the Internet, Local Area Networks, and Wide Area Networks.

1. **Star Topology** : A star topology is a design of a network where a central node extends a cable to each computer on the network. On a star network, computers are connected independently to the center of the network. If a cable is broken, the other computers can operate without problems. A star topology requires a lot of cabling.
2. **Bus Topology** : A **bus topology** is another type of design where a single cable connects all computers and the information intended for the last node on the network must run through each connected computer. If a cable is broken, all computers connected down the line cannot reach the network. The benefit of a bus topology is a minimal use of cabling.
3. **Ring Topology** : A similar topology is called a **ring**. In this design, computers are connected via a single cable, but the end nodes also are connected to each other. In this design, the signal circulates through the network until it finds the intended recipient. If a network node is not configured properly, or it is down temporarily for another reason, the signal will make a number of attempts to find its destination. A **collapsed ring** is a topology where the central node is a network device called a hub, a router, or a switch. This device runs a ring topology internally and features plugins for cables. Next, each computer has an independent cable, which plugs into the device. Most modern offices have a **cabling closet**, or a space containing a switch device that connects the network. All computers in the office connect to the cabling closet and the switch.

Components of a Computer Network

- **Server:** Server or Domain Controller is a powerful computer used in Domain network to manage and control all hardware and software, resources of a network. The server uses the server OS (Operating System), e.g., Win Server 2012. There are two types of Domain Controllers

- **Client:** A type of computer in a network that can request for resources to the server. There are two types of clients.

  Intelligent Client : This kind of client can only process data, They don't have the ability to store the data.

  Smart Client :These types of consumer benefit from both, They can process as well as store the data.

- **Peer:** Peer is a type of computer in a workgroup network that can act as a server as well as a client at the same time. Meaning, A peer can request and process a request simultaneously. Hence, It can act as both client and server.
- **Media:** Network Media or medium is the path through which data travels on a network. There are two main types of media:

  Guided Media: The media that has physical existence is called guided media or bounded media. Guided media consists of the following types of cables: Coaxial cable, Twisted pair cable, and Fiber Optic cable.

  Non Guided Media : A type of media which has no physical existence (Wireless) as a guided media. Some of the examples of Non-guided media are Radio Waves, Microwaves, Infrared waves

- **Connecting Devices:** These devices are used to connect a network media together. They act as a middleware between two computers or networks. The network contains the following connecting devices:
- Connectors.
- Hub.
- Switch.
- Router.
- B-Router.
- Bridge.
- Gateways.

Devices : The following describes the difference between a hub and a switch

- Hubs were typically chosen as an intermediary device within a very small LAN, where bandwidth usage was not an issue or there were cost limitations. In today's networks, hubs have been replaced by switches.
- Switches replaced hubs as the local area network (LAN) intermediary device because a switch can segment collision domains and provide enhanced security

Switches : When choosing a switch, the main factors to consider are the following:

- **Cost:** Determined by the number and type of ports, network management capabilities, embedded security technologies, and optional advanced switching technologies.
- **Interface characteristics:** Sufficient number of ports for now as well as for future expansion, uplink speeds, mixture of UTP and fiber, and modularity.
- **Hierarchical network layer:** Switches at the access layer have different requirements than switches at the distribution or core layers.

Routers: Routers are the primary devices used to interconnect networks—LANs, WANs, and WLANs. When choosing a router, the main factors to consider are the following:

- **Expandability:** Provides flexibility to add new modules as needs change.
- **Media:** Determines the type of interfaces the router needs to support the various network connections.
- **Operating system features:** Determines the version of IOS loaded on the router. Different IOS versions support different feature sets. Features to consider include security, QoS, Voice over IP (VoIP), routing complexity, and other services.

ASSESSMENT

1. What is network topology?
2. What are the two basic categories of network topology?
3. List and explain the types of topology?
4. List some of the components of a computer network

WEEK 3

Computer Science SS3 First Term

Topic: Network Cables and Connectors

Network Cable

Cable is the medium through which information usually moves from one network device to another. There are several types of cable which are commonly used with LANs. In some cases, a network will utilize only one type of cable, other networks will use a variety of cable types. The type of cable chosen for a network is related to the network's topology, protocol, and size. Understanding the characteristics of different types of cable and how they relate to other aspects of a network is necessary for the development of a successful network.

The following sections discuss the types of cables used in networks and other related topics.

- Unshielded Twisted Pair (UTP) Cable
- Shielded Twisted Pair (STP) Cable
- Coaxial Cable
- Fiber Optic Cable
- Cable Installation Guides
- Wireless LANs
- Unshielded Twisted Pair (UTP) Cable

Coaxial Cables

Invented in the 1880s, "coax" was best known as the kind of cable that connected television sets to home antennas. Coaxial cable is also a standard for 10 MbpsEthernet cables.

When 10 Mbps Ethernet was most popular, during the 1980s and early 1990s, networks typically utilized one of two kinds of coax cable – **thinnet** (10BASE2 standard) or **thicknet** (10BASE5). These cables consist of an inner copper wire of varying thickness surrounded by insulation and another shielding. Their stiffness caused network administrators difficulty in installing and maintaining thinnet and thicknet.

Fibre Optics Cable

Instead of insulated metal wires transmitting electrical signals, fiber optic network cables work using strands of glass and pulses of light.

These network cables are bendable despite being made of glass. They have proven especially useful in wide area network (WAN) installations where long distance underground or outdoor cable runs are required and also in office buildings where a high volume of communication traffic is common. Two primary types of fiber optic cable industry standards are defined – **single-mode**(100BaseBX standard) and **multimode** (100BaseSX standard).

Twisted Pair Cable

Twisted pair cabling is a type of wiring in which two conductors of a single circuit are twisted together for the purposes of canceling out electromagnetic interference (EMI) from external sources; for instance, electromagnetic radiation from unshielded twisted pair (UTP) cables, and crosstalk between neighboring pairs. In balanced pair operation, the two wires carry equal and opposite signals and the destination detects the difference between the two. This is known as differential mode transmission. Noise sources introduce signals into the wires by coupling of electric or magnetic fields and tend to couple to both wires equally. The noise thus produces a common-mode signal which is cancelled at the receiver when the difference signal is taken.

Straight Through Cable

Straight through cables are used to connect different devices like Switch to PC. Switch to Router. Router to Switch etc. Straight-through cables are used when each end of the communication transmits and receives on different pairs.

Cross Over Cable

In a cross over the cable, the send and receive wires are “crossed over”, meaning the wires are opposite on each end. This allows two PCs to talk to each other, has it connects the send of one computer to the receive of the other. Hence, the cross over cables are used to connect similar devices like PC to PC , Router to Router, Switch to Switch, Hub to Hub etc.

Roll Over Cable

Roll over cables are used to connect to the console port of the device. It gets the name rollover because the pin outs on one end are reversed from the other, as if the wire had been rolled over and you were viewing it from the other side.

Transmission Pins

Devices that transmit on 1,2 and receive on 3,6

1) PC

2)Router

3)Wireless Access Point AP

4) Networked printers

Devices that transmit on 3,6 and receive on 1,2

1)switch

2)bridge

3)hub

Guidelines to Installing Cable

When running cable, it is best to follow a few simple rules:

- Always use more cable than you need. Leave plenty of slack.
- Test every part of a network as you install it. Even if it is brand new, it may have problems that will be difficult to isolate later.
- Stay at least 3 feet away from fluorescent light boxes and other sources of electrical interference.
- If it is necessary to run cable across the floor, cover the cable with cable protectors.
- Label both ends of each cable.
- Use cable ties (not tape) to keep cables in the same location together.

ASSESSMENT

1. What is a network cable?
2. List the guidelines that must be observed when installing a network cable.
3. List some examples of network cables

WEEK 4

Computer Science SS3 First Term

Topic: INTRODUCTION TO WORLD WIDE WEB

THE INTERNET

Internet is defined as a global electronic communication network. It is one of the largest networks that link trillions of computers all over the world. You can access this network via communication devices and media such as modems, cable, telephone lines and satellite.

The **Internet** is a global system of interconnected computer networks that use the standard Internet protocol suite (TCP/IP) to link several billion devices worldwide. It is a *network of networks* that consists of millions of private, public, academic, business, and government networks of local to global scope, linked by a broad array of electronic, wireless, and optical networking technologies.

The internet offers many conveniences at your fingerprints. You can send messages to others, meet new friends, bank, invest, shop, fill prescription, file taxes, take online courses, play games, listen to music or watch a movie on the internet, the advantage of the internet is that you can use it from a computer anywhere in the world.

Success today in the business world requires knowledge of the internet. Without it, you are missing out on a tremendous source for goods, services, information and, communication.

Here are some of the things one can do on the internet.

- Banking called E-banking 0r Internet Banking
- Invest
- Shop for goods and services
- Watch movies
- Download and listen to music
- Access Educational material e.g. Passnownow.com
- Access source of entertainment and leisure, such as online games, magazines or vacation planning guide

- Access other computer and exchange files, share and edit document with other in real time
- Provide information, photographs or audio or video clips

HISTORY OF THE INTERNET

The history of the internet begin with the following

1. **ARPANET**: The US defense department created a project called Advanced Research Project Agency (ARPA) in late 1960s, which was to work as network that would allow scientist and military personnel to exchange information in war scenario without disruption in communications. The network was connected in a way which ensured that if one section of the network was damage, the remaining computer on the network would still be able to communicate with each other. This network was called ARPANET. By 1984, ARPANET had more than 1,000 individual computers linked as hosts.
2. **NSFNET**: In 1986, the national science foundation (NSF) connected its huge network of five supercomputer centre called NSFNET, to ARPANET. They used the technology developed for ARPANET to allow universities and schools to connect to each other. By 1987, NSFNET could no longer handle the amount of information that was being transferred. The national science foundation improved the network to allow more information to be transferred. This configuration of complex came to be known as the internet. Most of the people accessing the internet till late 1980s were scientist and researchers. In the early 1990s, many companies started to offer access to home users. This allows anyone with a modem and a computer to access the internet.

3. **WORLD WIDE WEB**: The World Wide Web was created in the early 1990s by European organization for nuclear research. The goal of WWW was also to allow researchers to work together on projects and to make project information easily accessible. The first publicly accessible website was created in 1991. By the mid 1990s, over 30 million people had access to the internet. Reach this huge market, most big companies created their own sites on the World Wide Web or

provide information about their products. Now there are thousand companies on the web.

Basic Terminologies

Internet – A global network connecting millions computers. As of 1998, the Internet has more than 100 million users worldwide, and that number is growing rapidly. More than 100 countries are linked into exchanges of data, news and opinions. Unlike online services, which are centrally controlled, the Internet is decentralized by design. Each Internet computer, called a host, is independent. Its operators can choose which Internet services to use and which local services to make available to the global Internet community

ISP – Short for Internet Service Provider, a company that provides access to the Internet. For a monthly fee, the service provider gives you a software package, username, password and access phone number. Equipped with a modem, you can then log on to the Internet and browse the World Wide Web and USENET, and send and receive e-mail.

Browser – Short for Web browser, a software application used to locate and display Web pages. The two most popular browsers are Netscape Navigator and Microsoft Internet Explorer

Domain name – A symbolic name for a computer, that can be translated by a nameserver into a computers formal numeric Internet address (IP address). Domain names let users reference Internet sites without having to know the numerical address.

URL – URLs make it possible to direct both people and software applications to a variety of information, available from a number of different Internet protocols. Abbreviation of Uniform Resource Locator, the global address of documents and other resources on the World Wide Web.

HTTP – Short for HyperText Transfer Protocol, the underlying protocol used by the World Wide Web. HTTP defines how messages are formatted and transmitted, and what actions Web servers and browsers should take in response to various commands.

Website – A site (location) on the World Wide Web. Each Web site contains a home page, which is the first document users see when they enter the site. The site might

also contain additional documents and files. Each site is owned and managed by an individual, company or organization.

HTML – Short for HyperText Markup Language, the authoring language used to create documents on the World Wide Web. Hypertext, for easy navigation among resources (e.g. HyperText Markup Language or HTML, a standard format for describing the structure of documents for transmission of hypermedia documents).

Homepage – The main page of a Web site. Typically, the home page serves as an index or table of contents to other documents stored at the site.

IP address – The numerical Internet protocol address of a computer on the Internet. Every computer on the Internet has a unique numerical address.

Intranet – An Intranet is a collection of services that use an Internet as the underlying communications technology, designed to support business operations and applications. Basically just another buzzword, like enterprise computing, and mission-critical applications.

Java – A programming language, developed by Sun Microsystems, designed specifically for use in applet and agent applications. Java programs can only run under a Java interpreter, which is designed to eliminate the risk of a rogue Java applet damaging the local computer.

Javascript – A scripting language developed by Netscape Inc. Javascript program listings can be included within an HTML document, and are then executed by the Web browser when the document is loaded. A similar scripting language, known as VBScript, has been developed by Microsoft.

Robots – On the World Wide Web, a program that autonomously searches through trees of hypertext documents, retrieving files for indexing (or other purposes). Also called a worm.

Router – A computer that determines, on a local basis, which route packets will take en route to their destination.

TCP/IP – Transmission Control Protocol/Internet Protocol, the basic communication protocol that is the foundation of the Internet. All the other protocols, such as HTTP, FTP, and Gopher, are built on top of TCP/IP.

WEB PAGE

Web page is an electronic document on the World Wide Web. A web page consists of a HTML file in a particular directory on a particular machine (and in thus identification by a URL) a vast amount of information is provided by these web pages. The information may include graphics, sounds, or even movies. Usually, a web page contains links to other pages as well

WEBSITE

A website is a collection of web pages. Most websites have a home page as their starting point, which frequently has a table of contents for the site. Users need a web browser and a connection to access a website.

HOME PAGE

Home page is the first page retrieved when accessing a website. It serves as a table of contents for the rest of pages on the site and offers links to other websites. For example, a company's welcome page typically includes the company logo, a brief description and links to the additional document available on that site.

UNIFORM RESOURCE LOCATOR

The uniform resource locator is the address that defines the router to a file on the web. URLs are typed into the browser to access web pages for example **https://www.passnownow.com** Retrieved home page for passnownow website. The http is the web protocol and www.passnownow.com is the domain name.

HYPERLINKS

Web pages contain highlighted text or image, called hyperlinks, that connect to other pages on the web. A hyperlink allows you to easily move through vast amount of information y jumping from one web page to another. You can select a hyperlink to jump to a web page located on the same computer or on a computer across the city, country or world. You can easily identify a text hyperlink in a web page because it appears underlined and in color.

WEB SERVER

A web server is a computer on the internet that stores web pages. A web page is available for other people to view, when it is stored in the we server.

WEB BROWSER

A web browser is a software program that allows you to access and view web pages. The web browser software is built on the hyperlinks, which allows users to point and click with a mouse in order to jump from one document to another in whatever order the are desire.

ASSESSMENT

1. Define Internet.
2. List 5 examples of things that can be done on the internet.
3. Describe the history of the internet.
4. What is a web server?
5. What is the full meaning of HTTP?

WEEK 5 & 6

Computer Science SS3 First Term'

Topic: Database & Database Organisation

DATABASE

A database is a collection of information that is organized so that it can be easily accessed, managed and updated. It is an organized collection of data. It is a collection of schemas, tables, queries, reports, views, and other objects. Database designers typically organize the data to model aspects of reality in a way that supports processes requiring information, such as (for example) modelling the availability of rooms in hotels in a way that supports finding a hotel with vacancies.

A database is a collection of information organized to provide efficient retrieval. The collected information could be in any number of formats (electronic, printed, graphic, audio, statistical, combinations). There are physical (paper/print) and electronic databases. It could be as simple as an alphabetical arrangement of names in an address book or as complex as a database that provides information in a combination of formats.

Computer databases typically contain aggregations of data records or files, such as sales transactions, product catalogs and inventories, and customer profiles.

Typically, a database manager provides users with the ability to control read/write access, specify report generation and analyze usage. Some databases offer ACID (atomicity, consistency, isolation and durability) compliance to guarantee that data is consistent and that transactions are complete.

Data is organized into rows, columns and tables, and it is indexed to make it easier to find relevant information. Data gets updated, expanded and deleted as new information is added. Databases process workloads to create and update themselves, querying the data they contain and running applications against it.

CONCEPT OF DATABASE

The concept of database is simply described as the terminologies of database such as

1. FIELD
2. RECORDS
3. FILE
4. KEY

FORMS OF DATABASE

The following are the forms of database

1. **FLAT FILE DATABASE**: flat file database store data in plain text file. Each line of the text file holds one record with field separated by diameters such as command or tabs.
2. **HIERARCHICAL DATABASE**: in hierarchical database records are linked in a tree like structure and each record type has only one owner. E.g an order is owned by only one customer
3. **RELATIONAL DATABASE**: This is a collection of data items organized is a set formally. Described table from which data can be accessed or reassemble in many different ways without having to recognize the database table. Each table contains one or more data categories in column. Each role contains unique types of data for the categories defined by columns.

TYPES OF DATABASE

One way to classify databases involves the type of their contents, for example: bibliographic, document-text, statistical, or multimedia objects. Another way is by their application area, for example: accounting, music compositions, movies, banking, manufacturing, or insurance. A third way is by some technical aspect, such as the database structure or interface type. This section lists a few of the adjectives used to characterize different kinds of databases.

- An in-memory database is a database that primarily resides in main memory, but is typically backed-up by non-volatile computer data storage. Main memory databases are faster than disk databases, and so are often used where response time is critical, such as in telecommunications network equipment.[27] SAP HANA platform is a very hot topic for in-memory database. By May 2012, HANA was able to run on servers with 100TB main memory powered by IBM. The co founder of the company claimed that the system was big enough to run the 8 largest SAP customers.
- An active database includes an event-driven architecture which can respond to conditions both inside and outside the database. Possible uses include security monitoring, alerting, statistics gathering and authorization. Many databases provide active database features in the form of database triggers.
- A cloud database relies on cloud technology. Both the database and most of its DBMS reside remotely, "in the cloud", while its applications are both developed by programmers and later maintained and utilized by (application's) end-users through a web browser and Open APIs.
- Data warehouses archive data from operational databases and often from external sources such as market research firms. The warehouse becomes the central source of data for use by managers and other end-users who may not have access to operational data. For example, sales data might be aggregated to weekly totals and converted from internal product codes to use UPCs so that they can be compared with ACNielsen data. Some basic and essential components of data warehousing include extracting, analyzing, and mining data, transforming, loading, and managing data so as to make them available for further use.
- A deductive database combines logic programming with a relational database, for example by using the Datalog language.
- A distributed database is one in which both the data and the DBMS span multiple computers.
- A document-oriented database is designed for storing, retrieving, and managing document-oriented, or semi structured data, information. Document-oriented databases are one of the main categories of NoSQL databases.

- An embedded database system is a DBMS which is tightly integrated with an application software that requires access to stored data in such a way that the DBMS is hidden from the application's end-users and requires little or no ongoing maintenance.[28]
- **End-user databases** consist of data developed by individual end-users. Examples of these are collections of documents, spreadsheets, presentations, multimedia, and other files. Several products exist to support such databases. Some of them are much simpler than full-fledged DBMSs, with more elementary DBMS functionality.
- A federated database system comprises several distinct databases, each with its own DBMS. It is handled as a single database by a federated database management system (FDBMS), which transparently integrates multiple autonomous DBMSs, possibly of different types (in which case it would also be a heterogeneous database system), and provides them with an integrated conceptual view.
- Sometimes the term *multi-database* is used as a synonym to federated database, though it may refer to a less integrated (e.g., without an FDBMS and a managed integrated schema) group of databases that cooperate in a single application. In this case, typically middleware is used for distribution, which typically includes an atomic commit protocol (ACP), e.g., the two-phase commit protocol, to allow distributed (global) transactions across the participating databases.
- A graph database is a kind of NoSQL database that uses graph structures with nodes, edges, and properties to represent and store information. General graph databases that can store any graph are distinct from specialized graph databases such as triplestores and network databases.
- An array DBMS is a kind of NoSQL DBMS that allows to model, store, and retrieve (usually large) multi-dimensional arrays such as satellite images and climate simulation output.
- In a hypertext or hypermedia database, any word or a piece of text representing an object, e.g., another piece of text, an article, a picture, or a film, can be hyperlinked to that object. Hypertext databases are particularly useful for organizing large amounts of disparate information. For example, they are useful

for organizing online encyclopedias, where users can conveniently jump around the text. The World Wide Web is thus a large distributed hypertext database.

- A knowledge base (abbreviated **KB**, **kb** or Δ[29][30]) is a special kind of database for knowledge management, providing the means for the computerized collection, organization, and retrieval of knowledge. Also a collection of data representing problems with their solutions and related experiences.

- A mobile database can be carried on or synchronized from a mobile computing device.
- Operational databases store detailed data about the operations of an organization. They typically process relatively high volumes of updates using transactions. Examples include customer databases that record contact, credit, and demographic information about a business' customers, personnel databases that hold information such as salary, benefits, skills data about employees, enterprise resource planning systems that record details about product components, parts inventory, and financial databases that keep track of the organization's money, accounting and financial dealings.
- A parallel database seeks to improve performance through parallelization for tasks such as loading data, building indexes and evaluating queries.

  The major parallel DBMS architectures which are induced by the underlying hardware architecture are:

- **Shared memory architecture**, where multiple processors share the main memory space, as well as other data storage.
- **Shared disk architecture**, where each processing unit (typically consisting of multiple processors) has its own main memory, but all units share the other storage.
- **Shared nothing architecture**, where each processing unit has its own main memory and other storage.

- Probabilistic databases employ fuzzy logic to draw inferences from imprecise data.

- Real-time databases process transactions fast enough for the result to come back and be acted on right away.
- A spatial database can store the data with multidimensional features. The queries on such data include location-based queries, like “Where is the closest hotel in my area?”.
- A temporal database has built-in time aspects, for example a temporal data model and a temporal version of SQL. More specifically the temporal aspects usually include valid-time and transaction-time.
- A terminology-oriented database builds upon an object-oriented database, often customized for a specific field.
- An unstructured data database is intended to store in a manageable and protected way diverse objects that do not fit naturally and conveniently in common databases. It may include email messages, documents, journals, multimedia objects, etc. The name may be misleading since some objects can be highly structured. However, the entire possible object collection does not fit into a predefined structured framework. Most established DBMSs now support unstructured data in various ways, and new dedicated DBMSs are emerging.

DATABASE ORGANISATION

There are four main types of database organization:

- Flat
- Hierarchical
- Relational
- Object-oriented

Flat databse organization.

A “flat file” is a plain text or mixed text and binary file which usually contains one record per line or ‘physical’ record. Such as a list of names, addresses, and phone numbers written on a sheet of paper is a flat file database. This can also be done with any typewriter or word processor. A spreadsheet or text editor program may be used to implement flat file databases.

Hierarchical database organization.

A database organization method that is structured in a hierarchy. In a hierarchical database, records contain groups of parent/child relationships, similar to a tree structure. Hierarchical databases are fast and simple but inflexible as the relationship is restricted to one-to-many, only allowing for one parent segment per child.

Relational Database organization.

A relational database is a collection of data items organized as a set of formally described tables from which data can be accessed easily. relational databases are one of the most effective type of database organization. Relational database systems are an application of mathematical set theory to the problem of effectively organizing data.

A relational database is created using the relational model. The software used in a relational database is called a relational database management system (RDBMS). A relational database is the predominant choice in storing data, over other models like the hierarchical database model or the network model.

The standard user and application program interface to a relational database is the structured query language (SQL). SQL statements are used both for interactive queries for information from a relational database and for gathering data for reports.

Object-oriented database organization.

An object-oriented database organization is a database management system in which information is represented in the form of objects as used in object-oriented programming. This includes some kind of support for classes of objects and the inheritance of class properties and methods by subclasses and their objects.

ASSESSMENT

1. Define database
2. What is the database concept?
3. What are the forms of databases?

4. List 6 types of databases
5. List and explain the four main types of database organization.

WEEK 7 & 8

Computer Science SS3 First Term

Topic: Graphic Introduction to Corel Draw

CorelDRAW is a vector illustration program. Images are displayed on the computer screen as pixels. How the program treats the pixels is determined by whether the image is defined as a vector or a bitmap. A bitmap file defines the position, color and size of each pixel. A vector program defines a line of pixels and treats them as a single object. To change an object in a bitmap, you must change all the pixels, so if a red box on a blue background needs to be smaller, you have to re-create a smaller red box and change the pixels where the box was to the blue background. When you have a vector image, you redefine the size and location of the lines. Each object is independent of the others and can be manipulated as needed. To make your work easier, Corel Corporation has added a few bitmap manipulation tools in DRAW and includes its bitmap manipulation program, CorelPhotoPaint, when you purchase CorelDRAW.

CorelDRAW is one of the most powerful and versatile illustration programs on the market today, on any platform. In this class, I cannot teach you all you can do with this program. I can only show you how to use the tools and effects included in the program. What you do with CorelDRAW is limited only by your imagination, time, and budget. In my personal experience, I have seen projects ranging from fine art frescoes to silk-screened T-shirts to laser engraved stainless steel parts. Your use may be as ordinary as a flyer for a garage sale or as complex as the annual report for a Fortune 500 company. From desktop publishing to fine art, CorelDRAW gives you the tools. I can only teach you the skills to use them. The talent, inspiration and effort come from you.

1. When **CorelDRAW** is loaded, a new section is created on the **Start Menu** . To open DRAW, click the Start button from the **Taskbar** .
   This opens the Windows Start menu.

2. Select **Programs** from the list.
   This activates the Programs panel. Programs are contained in groups, but rather than being initially displayed in a group window, each group is listed.

3. Find the **Corel** section and select **CorelDRAW 12**.
   This opens up the program with the CorelDRAW welcome screen. If you have used the program before, you may have turned off this screen.

4. Choose **Open Graphic** or use the **Open** command on the **File menu** .
   New Graphic creates a new, one page document. *Open Last Edited* opens the last document you had open. The splash screen will show the names of the files over the icon. The *Template*icon allows you to access many professionally created templates you can then modify for your own projects.
   The *CorelTutor* gives you a brief overview of how to use the program and *What's New?* shows you all the improvements from Version 11.
   Designer.com connects you to the Corel Designer.com web site where you can find many helpful areas. If you clear the check from the box in the lower left corner, you will not see this graphic but will open a new file when you open the program.
5. Direct the **Explorer** to your hard drive and the folder where you saved the class files.
6. Choose the file **Open 1st.cdr** .
   If the Panose Screen appears listing fonts that are not loaded, click the OK button. This utility allows you to load fonts for a document when you open the document. You must have the Font Navigator utility loaded and active for the fonts to install automatically.
7. Window Components
   The various window components in CorelDraw are: • Title bar • Menu bar • Property bar • Tool bar (Standard) • Tool box • Rulers • Drawing page • Drawing window • Colour palette • Docker • Status bar • Document navigator • Navigator

The CorelDRAW Window.

Window Components	
A – Standard Toolbar	You can customize this or any other Toolbar or create additional Toolbars.
B – Property Bar	The Property Bar is dynamic. Property options change depending on what you are working on. This enables you to access commands that are specific to the current tool or feature you are using.
C – Main Tool Box	The main tools you will use are accessed from this bar.
D – Rulers	The Rulers show the current mouse cursor location as you move in the work area.
E – Color Palette	The Color Palette by default is located to the right of the work window. Like the Toolbars, it can also be relocated. You can choose from a preset palette of colors, or use a specific color system such as Pantone Spot Colors.
F – Status Bar	The Status Bar is used to give you information about cursor movements or symbol properties such as the fill or size.
G – Page Navigator	The Page Selector is used to add and move between pages. When a file contains multiple pages, individual page tabs appear to the right of the Page Selector bar.
H – Docker Tabs	Dockers allow access to effects, styles, colors, and many other features of CorelDRAW. They can be floated or “docked” at the side of the window. When closed, they are accessible through a vertical tab.

Tool Overview

The Toolbox is located in the left portion of the window and contains all the drawing and editing tools necessary to create objects for an illustration. Tools containing a small triangle in the corner produce a Flyout. Flyouts contain additional tools, or tool options and are explained below in the order they appear on the default screen. Flyouts are described following the Tool Overview.

Pick Tool	Selects objects or groups of objects. Once selected, you can use the Pick Tool of move, stretch, scale, rotate, and skew objects.
Shape Tool	Reshapes objects. Objects are reshaped by moving nodes, lines, and control points.
Zoom Tool	Changes the current view of the drawing. You can also select magnification options from the Property Bar in the Zoom mode.
Freehand Tool	Draws lines and curves. You can also use this tool to trace bitmaps.
Smart Drawing Tool	Converts the freehand strokes you draw to basic shapes and smoothed curves.
Rectangle Tool	Draws rectangles and squares. Squares are created by using the Control key while drawing.
Ellipse Tool	Draws ellipses and circles. Circles are created by holding down the Control key as you draw.
Graph Paper Tool	Draws a collection of boxes that simulates a sheet of graph paper.
Perfect Shapes Tool	A collection of objects which you can add to your drawing. They include such things as arrows, stars, talk bubbles, and flow chart symbols.
Text Tool	Adds either Artistic or Paragraph text to your drawing.

Interactive Blend Tool	The Blend Tool allows you to merger objects together through a series of steps. The flyout gives access to several more interactive tools that are described on the following pages.
Eyedropper Tool	The Eyedropper Tool allows you to select a color within an object, especially a bitmap, and allows you to apply that color to another object. You can also capture the color for a customized palette. The flyout gives access to the paint bucket that applies the color.
Outline Tool	Sets the outline style of an object or a line. This includes the line type, ends, color, and weight. The flyout gives quick access to some changes.
Fill Tool	Assigns the fill style of any object. Fills are only visible on closed objects. The flyout gives access to control dialogs for each type of fill.
Interactive Fill Tool	Allows you to apply Fountain fills (gradients) using the mouse. The flyout gives access to the Mesh fill Tool.

ASSESSMENT

1. What is corel draw and what can it be used for?

WEEK 9 & 10

Computer Science SS3 First Term

Topic: Basic Programming

BASIC Programming

In 1964, John G. Kemeny and Thomas E. Kurtz designed the original **BASIC language** at Dartmouth College in New Hampshire.

B – Beginners

A – All purpose

S – Symbolic

I – Instructional

C – Code

Basic Arithmetic Expressions

Basic arithmetic expressions and algebraic expressions are similar with little different examples of basic arithmetic expressions. Arithmetic expressions are composed of a combination of constants, variables, operation symbols, and functions. An expression may be very simple or quite complex, but it will result in a single value. Whether an expression is simple or complex, the calculations must be performed in a specific order. To ensure the computer will correctly evaluate and calculate arithmetic expressions, you have to learn to code them using the rules of BASIC. In order to use arithmetic expressions efficiently, you must be able to evaluate and convert conventional mathematical expressions into proper BASIC expressions.

I = {P*R*T}/100

Basic arithmetic expressions and their algebraic expressions

ALGEBRAIC EXPRESSION	BASIC ARITHMETIC EXPRESSION
B + D	B + D
A – B	A – B
B C	B / C
D^2	D ^2

C + B÷D	C + B* D
B = B x H	B – B* D
P = ax – bx + c/2	P = a*x – b*x + c/2
$a(b-d)^3 \div d+1$	$a* \{b-d\}^3/d+1$
B – (-a+b) 2a	B = {-a+b}/2*a
$b^2 – 5bc -3b$	SQR {b} ^ c $^{-5}$* b* – 3b
(b +c) +d Sin b	{b+c} + d/Sin {b}

Sign	Arithmetic Expression	Basic Expression	Name
{ }	14 + 2	{14 + 2}	Bracket
Of	½ of 5	5 * 2	Exponential
/	24 ÷ 4	24/4	Division
x	6 x 5	6 * 5	Multiplication
+	2 + 3	2 + 3	Addition
–	3 – 2	3 – 2	Subtraction
√	√16	SQR {16}	Square root

Parentheses Rule

There are cases where the precedence rule may cause a problem. For example:
The BASIC expression LET Y = A/B+ C would produce undesired results, because A would be divided by B and the result added to C. The solution to this problem is in the use of *parentheses.* If we let parentheses override the order of precedence (but maintain the order of precedence within the parentheses), the result will be satisfactory. Now let's examine the previous example using *parentheses.*
Example:

Using parentheses

With the parentheses, B is added to C and the sum of this operation is divided into A, giving the correct result.
Sometimes more than one set of parentheses may be needed to tell the BASIC language in what order to execute the arithmetic operations.

Example:

Parentheses inside parentheses

The BASIC expression to accomplish this would be:

For this expression to give us the correct results, A and B must be added first, then the sum divided by C, and finally that result is squared. When parentheses within parentheses are used, the innermost parentheses will be evaluated first. Addition has a lower precedence than either division or exponentiation; therefore, A + B must be in the inner parentheses. Division has a lower precedence than exponentiation, so (A+B)/C also must be enclosed in parentheses, ((A+B)/C), to ensure it is performed next.

The important thing to remember is the parentheses maybe used to over-ride the normal order of precedence. The *parentheses rule* says:

. Computations inside parentheses are performed first.

. If there are parentheses inside parentheses, the operations inside the inner pair are performed first.

SUMMARY

Simple problems can be solved with BASIC by using only two or three instructions. These are the END, PRINT and LET statements. To use these effectively, you must know how they work and what rules must be followed in using them.

The END statement, which must be the last statement in every BASIC program, has two functions. It indicates to the compiler that there are no more BASIC statements for it to translate and it terminates execution of the program.

The PRINT statement is used to instruct the computer to output something either on the terminal or the printer. The standard print line in BASIC is divided into print zones or fields of 16 spaces each.

The two punctuation marks used in PRINT statements are the comma and semicolon. A comma used as a separator in a PRINT statement causes standard spacing and a semicolon causes packed spacing.

Information enclosed in quotation marks in a PRINT statement will be printed exactly as it appears in the program.

The LET statement can be used to assign a constant value to a variable name, a variable to a variable name, or the results of an expression to a variable name. The

equal sign in a LET statement does not indicate algebraic equality, rather it means be assigned the value of. The value assigned by a LET statement is stored in the computer's memory; therefore, it can be referenced by its variable name.

Both the PRINT and LET statements may contain expressions with arithmetic operations. These arithmetic operations must be specified by the appropriate operation symbol. Should you forget to include the symbol, the computer will not insert it for you, but will give you an error message.

Constants and variables are used to refer to numeric values or character strings. A constant is a whole or decimal number or character string whose value does not change. A variable name is an arbitrary name you select and you and the computer use to refer to a value stored in the computer's memory. This value may vary during execution of the program, but can contain only one value at a time.

ASSESSMENT

1. What is the full meaning of BASIC?
2. What is the parenthesis rule?

SS 3

SECOND TERM NOTES ON COMPUTER SCIENCE

TABLE OF CONTENT

SECOND TERM

WEEK 1 & 2

Computer Science SS3 Second Term

Topic: High Level Language

Programming Language

This is a process that results in the development of a set of detailed instructions following a pattern of a particular programming language necessary to solve a problem. A **programming language** is a formal constructed language designed to communicate instructions to a machine, particularly a computer. Programming languages can be used to create programs to control the behavior of a machine or to express algorithms. A vocabulary and set of grammatical rules for instructing a computer to perform specific tasks. High-level programming languages, while simple compared to human languages, are more complex than the languages the computer actually understands, called *machine languages*. Each different type of CPU has its own unique machine language.

Levels of Languages

Each language has a unique set of keywords (words that it understands) and a special syntax for organizing program instructions.

- Machine language
- Low level language
- High level language
- Natural level language

1. **Machine language**: This was the first level of language known to man. It involves the use of binary digits ie 0s and 1s to write programs and instructions.
2. **Low level language**: This was the next language developed after the machine language. It involves the use of binary code.
3. **High level language**: A high level language has the instructions which are similar to English language. It is very user friendly. It is much easier to understand and write with a program using this language. The greatest advantages of these

languages are its independence. A program written in HLL can be used on almost all computers without any change. The instructions written in HLL are also converted into machine language with the help of translators. Interpreter and compiler are two program used to translate a high level language into machine language so that the computer can understand it. They are highly developed languages and are currently used by programmers in the world today. It involves the use of English to write programming instructions. The invention of high level language has made it easy for programmers to develop programs in the shortest possible time.

- **SOME HIGH LEVEL PROGRAMS**
- **BASIC**: It stands for Beginner's all purpose symbolic instruction code. It is a programming language used by beginners
- **LOGO**: It stands for Language of Graphics Oriented. It is a programming language used to draw different shapes and figure.
- **COBOL**: It stands for common business oriented language. This language is specially designed for business application
- **FORTRAN**: It stands for 'Formula Translation'. It is one of the oldest high level languages. This language was designed to solve scientific problems
- **C AND C++**: They are the general purpose programming languages popular on minicomputer and microcomputer. They are the most widely used language for developing commercial applications.
- **JAVA**: Java is a programming language developed to write programs. It helps in creating games and animation and in developing multimedia effect for the internet.

ASSESSMENT

1. Programming language 'FORTRAN' stands for
   (a) formula translator
   (b) formula translation
   (c) free translator
   (d) free translation

2. Programming language which is used for scientific purposes and language work is to be done in batches is called
   (a) PASCAL
   (b) FORTRAN
   (c) LOGO
   (d) COMAL
3. Programming language 'COMAL' stand for
   (a) Common Algorithmic Language
   (b) Common Arithmetic Language
   (c) Common Arithmetic Learning
   (d) Common Algorithmic Learning
4. Programming language which is extension of 'BASIC' is
   (a) PASCAL
   (b) COBOL
   (c) LOGO
   (d) COMAL
5. Programming language used to encourage logical thinking is classified as
   (a) PASCAL
   (b) COBOL
   (c) LOGO
   (d) COMAL

ANSWERS

1. a
2. b
3. a
4. d
5. c

WEEK 3

Computer Science SS3 Second Term

Topic: Overview of Number Bases

Human nature dictates that we try to quantify everything we come in contact with, e.g. the number of students in a class, the number of eggs in a basket, etc. If we think about the type of things humans try to quantify, we can see that they are not all quantified in the same units of measure, e.g. time is measured in hours, minutes and seconds but the distance from Glasgow to Edinburgh is measured in miles. Therefore, a number system defines a set of values used to represent a quantity. Number Systems can be traced back to the early civilisations of Egypt and Babylon. These cultures could perform arithmetic operations on whole numbers, i.e. numbers without a decimal point. Number bases are different ways of writing and using the same number. We use a system called base 10, or denary, for our arithmetic, but there are almost as many number bases as there are numbers. Many people think that we use base 10 because we have 10 fingers on which we can count. Computers, and other electronic devices, can only reliably use an electrical current, or the absence of a current, to count (like having two fingers), and so they tend to use base 2 (binary) internally.

There are many number systems that have been, and still are in use, some of which may be familiar, these include Arabic, Babylonian, Mayan and Roman. The Roman number system uses numerals to represent each number, e.g. the number 5 is represented as V. In contrast, the most commonly used system is the Arabic system which uses the digits 0 to 9. This number system was used as early as the 3rd Century BC.

Each number system can be defined by its base (sometimes referred to as the radix). This base value of the number system indicates the number of different values the set has before repeating itself, e.g. Decimal has a base of ten values, hence, the digits 0-9, Octal has a base of 8 values, hence the digits 0-7.

You can work in any number base (except 1, which wouldn't really make sense), and some programming languages such as Lisp let you do that. In computing, however, you generally only come across the following four bases, and you know

base 10 already. These common bases also have proper names, shown in parentheses:

- base 2 (binary)
- base 8 (octal)
- base 10 (denary)
- base 16 (hexadecimal)

The largest digit you can have in any column is the one less than the number of the base. So for binary (base 2) it's 1, then 7 for Octal (base 8), 9 for Denary (base 10), etc.

After base 10, however, we run out of digits to represent the numbers, so we have to use letters, where A = 10, B = 11, C = 12, etc. So the sequence for numbers written in Hexadecimal is 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F, followed by 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 1A, 1B, 1C, 1D, E, 1F, etc.

When we write a number in base 10, we know its value because we multiply the individual digits by their corresponding column headings. For example, when we see 123, even if we don't think about it, we calculate 1 x 100 + 2 x 10 + 3 x 1 to give us one hundred and twenty three. Other number bases work in exactly the same way.

You can use this information to convert numbers in other bases to base 10, e.g.:

32 16 8 4 2 1

$1\,0\,1\,1_2 = 8 + 2 + 1 = 11_{10}$

32768 512 64 8 1

$= 1 \times 512 + 2 \times 64 + 3 \times 8 + 4 \times 1_{10}$

$1\quad 2\quad 3\,4_8 = 512 + 128 + 24 + 4_{10}$

$= 668_{10}$

Binary (Base 2)

You probably won't encounter binary much these days, but it's useful to understand that this is how computers work internally, so you can understand concepts such as parallel transmission. The fact that computers use binary is why everything is a multiple of 2 – why computers come with 8Mb, 16Mb, 32Mb, 64Mb, etc., of memory, rather than 10Mb, 20Mb, 30Mb, etc., and also why there are 1024 bytes in a kilobyte ($1024 = 2^{10}$) rather than 1000 bytes.

It's main use is probably in combination with the bitwise logic techniques shown on the previous page, to combine and split values stored in the same byte (or word).

There are some other binary-related terms you'll need to know. Firstly, a *bit* is a *binary digit* – i.e. a single occurrence of 0 or 1. This is the smallest unit of storage you can have inside a computer. Groups of 8 bits are called *bytes*. A byte can be used to represent a number, or a colour, or a character (e.g. using ASCII). You may also hear the term *nibble*, which is 4 bits. Finally, a *word* is the largest numbers of bits that a processor can handle in one go – for example, when we say that new computers have 64-bit processors, we mean that the word length is 64-bits, or 8 bytes.

The largest value that you can store using a particular numbers of bits can be determined quite easily. Using *n* bits, the largest value you can store is $2^n - 1$, and the number of different values you can store is 2^n (from 1 to $2^n - 1$, and then 0 as well). So using 8 bits, the largest number you can store is $2^8 - 1 = 255$, and the number of possibly values is $2^8 = 256$ (i.e. 0 – 255). A 32-bit computer can therefore handle values up to 4,194,967,296 in one clock cycle – it can obviously cope with larger numbers, but it would need to split them up first.

Octal (Base 8)

I've never come across anything that uses octal! I think it's probably included on exam specifications for purely academic reasons, and because it's easy to convert into binary (see below).

Hexadecimal (Base 16)

Hexadecimal is still used quite a lot – particularly for things like colours in HTML or programming languages. It's also quite useful because representations of large numbers are relatively compact, but are easily converted to binary so that you can see the bit patterns.

Shifting Bits

You've no doubt noticed that with numbers in base 10, you can move the digits left or right one place by multiplying or dividing the number by 10. The same trick works with different number bases – you just multiply and divide by the base number (e.g. multiply by 2 in binary to shift the bits left one place).

This can be useful for things like creating hexadecimal colour values (e.g. for web pages). In a 24-bit system (such as HTML), colours are represented by 24-bit numbers from 000000 to FFFFFF (each hexadecimal digit corresponds to 4 bits – see below). The 24 bits are made up of 8 bits each for the amount of red, green and blue in the colour.

So, each component is represented by 8 bits – i.e. a number from 0 to 255. If you know how much red, green and blue you want, how do you combine them to find the complete colour? For HTML, the correct order of the bits is RRGGBB (r = red, g = green, b = blue), so what we need to do is "shift" the values of green and red components, and then add all three components together.

We can leave the blue value as it is, but we need to move the green value along two places. To move along one place in hexadecimal, we multiply by 16, so to move along two places, just do it twice – 16 x 16 = 256 – so multiply the green value by 256. For the red value, we need to move four places – 16 x 16 x 16 x 16 = 65,536 – so we multiply the value of the red component by 65,536.

Obviously, if you were just trying to work out the colour yourself, you wouldn't need to go through these steps, but if you were to create a program like my colour mixer, then this is how you'd do it.

Binary

Let's look at base-two, or binary, numbers. How would you write, for instance, 12_{10} ("twelve, base ten") as a binary number? You would have to convert to base-two columns, the analogue of base-ten columns. In base ten, you have columns or "places" for $10^0 = 1$, $10^1 = 10$, $10^2 = 100$, $10^3 = 1000$, and so forth. Similarly in base two, you have columns or "places" for $2^0 = 1$, $2^1 = 2$, $2^2 = 4$, $2^3 = 8$, $2^4 = 16$, and so forth.

The first column in base-two math is the units column. But only "0" or "1" can go in the units column. When you get to "two", you find that there is no single solitary digit that stands for "two" in base-two math. Instead, you put a "1" in the twos column and a "0" in the units column, indicating "1 two and 0 ones". The base-ten "two" (2_{10}) is written in binary as 10_2.

A "three" in base two is actually "1 two and 1 one", so it is written as 11_2. "Four" is actually two-times-two, so we zero out the twos column and the units column, and

put a “1” in the fours column; 4_{10} is written in binary form as 100_2. Here is a listing of the first few numbers:

decimal (base 10)	binary (base 2)	
0	0	0 ones
1	1	1 one
2	10	1 two and zero ones
3	11	1 two and 1 one
4	100	1 four, 0 twos, and 0 ones
5	101	1 four, 0 twos, and 1 one
6	110	1 four, 1 two, and 0 ones
7	111	1 four, 1 two, and 1 one
8	1000	1 eight, 0 fours, 0 twos, and 0 ones
9	1001	1 eight, 0 fours, 0 twos, and 1 one
10	1010	1 eight, 0 fours, 1 two, and 0 ones
11	1011	1 eight, 0 fours, 1 two, and 1 one
12	1100	1 eight, 1 four, 0 twos, and 0 ones
13	1101	1 eight, 1 four, 0 twos, and 1 one
14	1110	1 eight, 1 four, 1 two, and 0 ones
15	1111	1 eight, 1 four, 1 two, and 1 one
16	10000	1 sixteen, 0 eights, 0 fours, 0 twos, and 0 ones

Converting between binary and decimal numbers is fairly simple, as long as you remember that each digit in the binary number represents a power of two.

Convert 101100101_2 to the corresponding base-ten number.

I will list the digits in order, and count them off from the RIGHT, starting with zero: The first row above (labelled “digits”) contains the digits from the binary number; the second row (labelled ” numbering”) contains the power of 2 (the base) corresponding to each digits. I will use this listing to convert each digit to the power of two that it represents:

$1\times2^8 + 0\times2^7 + 1\times2^6 + 1\times2^5 + 0\times2^4 + 0\times2^3 + 1\times2^2 + 0\times2^1 + 1\times2^0$

$= 1\times256 + 0\times128 + 1\times64 + 1\times32 + 0\times16 + 0\times8 + 1\times4 + 0\times2 + 1\times1$

= 256 + 64 + 32 + 4 + 1

= 357

Then 101100101_2 converts to 357_{10}.

Operations with binary numbers

We can add, subtract and multiply binary numbers in much the same ways as we operate with base ten numbers. The main things to remember in base two are:

Addition:

0 + 0 = 0 1 + 0 = 1

0 + 1 = 1 1 + 1 = 10

Multiplication:

0 X 0 = 0 1 X 0 = 0

0 X 1 = 0 1 X 1 = 1

Add the following

```
  1011
+ 1101
———
 11000
———
```

ASSESSMENT

1. $(1010.011)_2$ =
   (a) $(10.365)_{10}$
   (b) $(10.375)_{10}$
   (c) $(11.365)_{10}$
   (d) $(11.375)_{10}$
2. (41)⊂10 in binary is
   (a) 101101
   (b) 101011
   (c) 101001
   (d) 101101

3. Convert (0.6875)⊂10 to binary
   (a) 0.1011
   (b) 0.1011
   (c) 0.0101
   (d) 0.0111
4. Convert $(153.513)_{10}$ in octal number system is(a) 231.408517
   (b) 231.407517
   (c) 231.406517
   (d) 231.406617
5. All these are different types of number systems except
   (a) Arabic
   (b) Babylonian
   (c) Roman
   (d) Nigerian

ANSWERS

1. b
2. c
3. a
4. c
5. d

WEEK 4

Computer Science SS3 Second Term

Topic: Data Representation

Data and instructions cannot be entered and processed directly into computers using human language. Any type of data be it numbers, letters, special symbols, sound or pictures must first be converted into machine-readable form i.e. binary form. Due to this reason, it is important to understand how a computer together with its peripheral devices handles data in its electronic circuits, on magnetic media and in optical devices.

- The terms bits, bytes, nibble and word are used widely in reference to computer memory and data size.
- **Bits:** can be defined as either a binary, which can be 0, or 1.It is the basic unit of data or information in digital computers.

- **Byte:** a group of bits (8 bits) used to represent a character. A byte is considered as the basic unit of measuring memory size in computer.
- **A nibble**: is half a byte, which is usually a grouping of 4 bytes.

- **Word:** two or more bits make a word. The term **word length** is used as the measure of the number of bits in each word. For example, a word can have a length of 16 bits, 32 bits, 64 bits etc.

Data representation in digital circuits

- Electronic components, such as microprocessor, are made up of millions of electronic circuits. The availability of high voltage(on) in these circuits is interpreted as '1' while a low voltage (off) is interpreted as '0'.This concept can be compared to switching on and off an electric circuit. When the switch is closed the high voltage in the circuit causes the bulb to light ('1' state).on the other hand when the switch is open, the bulb goes off ('0' state). This forms a

basis for describing data representation in digital computers using the binary number system.

Data representation on magnetic media

- The laser beam reflected from the land is interpreted, as 1.The laser entering the pot is not reflected. This is interpreted as 0.The reflected pattern of light from the rotating disk falls on a receiving photoelectric detector that transforms the patterns into digital form.The presence of a magnetic field in one direction on magnetic media is interpreted as 1; while the field in the opposite direction is interpreted as “0”.Magnetic technology is mostly used on storage devices that are coated with special magnetic materials such as iron oxide. Data is written on the media by arranging the magnetic dipoles of some iron oxide particles to face in the same direction and some others in the opposite direction

Data representation on optical media

In optical devices, the presence of light is interpreted as ‘1’ while its absence is interpreted as ‘0’.Optical devices use this technology to read or store data. Take example of a CD-ROM, if the shiny surface is placed under a powerful microscope, the surface is observed to have very tiny holes called **pits**. The areas that do not have pits are called **land**.

Types of Data Representation

- Computers not only process numbers, letters and special symbols but also complex types of data such as sound and pictures. However, these complex types of data take a lot of memory and processor time when coded in binary form.
- This limitation necessitates the need to develop better ways of handling long streams of binary digits.
- Higher number systems are used in computing to reduce these streams of binary digits into manageable form. This helps to improve the processing

speed and optimize memory usage.

- **Number systems and their representation**
- **A number system** is a set of symbols used to represent values derived from a common base or radix.
- As far as computers are concerned, number systems can be classified into two major categories:
- decimal number system
- binary number system
- octal number system
- hexadecimal number system

Decimal number system

- The term decimal is derived from a Latin prefix deci, which means ten. Decimal number system has ten digits ranging from 0-9. Because this system has ten digits; it is also called a base ten number system or denary number system.
- A decimal number should always be written with a subscript 10 e.g. X_{10}
- But since this is the most widely used number system in the world, the subscript is usually understood and ignored in written work. However ,when many number systems are considered together, the subscript must always be put so as to differentiate the number systems.
- The magnitude of a number can be considered using these parameters.
- Absolute value
- Place value or positional value
- Base value
- **The absolute** value is the magnitude of a digit in a number. for example the digit 5 in 7458 has an absolute value of 5 according to its value in the number line.
- **The place value** of a digit in a number refers to the position of the digit in that number i.e. whether; tens, hundreds, thousands etc.
- **The total value** of a number is the sum of the place value of each digit making the number.

- **The base value** of a number also k known as the **radix**, depends on the type of the number systems that is being used .The value of any number depends on the radix. for example the number 100_{10} is not equivalent to 100_2.
- Number System defines a set of values used to represent 'quantity'.**Base or Radix:** The total number of digits available in a number system .**Decimal Number System:**

There are 10 digits i.e 1, 2, 3, 4, 5, 6, 7, 8, 9 available in decimal number system. It is known as Base 10 system. The value of a digit in a number depends upon its position in the number e.g. the number 546 in this system is represented as $(546)_{10}$
$546 = (4*10^2) + (8*10^1) + (6*10^0)$

Binary Number System

The Binary Number System contains 2 unique digits 0 and 1. it is known as Base 2 system.

Octal Number System

There are 8 unique digits available in octal number system. These are 0, 1, 2, 3, 4, 5, 6, 7. thus, any number formed is the combination of these digits. It is known as Base 8 system.

Hexadecimal Number System

There are 16 unique digits available in Hexadecimal number system. These are 0, 1, 2, 3, 4, 5, 6, 7, 8, A, B, C, D, E, F where A denotes 10, B denotes 11…….,F denotes 15. thus any number formed is a combination of these digits. It is known as Base 16 system

Converting Decimal to Binary, Octal and Hexadecimal

Integer Part

Remainder method

1. Divide the decimal number by the base of the target number system that is, to convert decimal to binary, divide the decimal number with 2 (the base of binary number system), 8 for octal and 16 for hexadecimal.
2. Note the remainder separately as the first digit from the right. In case of

hexadecimal , if the remainder exceeds 9, convert the remainder into equivalent hexadecimal form. For e.g., if the remainder is 10 then note the remainder as A.
3. Continually repeat the process of dividing until the quotient is zero and keep writing the remainders after each step of division.
4. Finally, when no more division can occur, write down the remainders in reverse order.

Fractional Part

1. Multiply the fractional part by the value of the new base.
2. Record the integer part if it exits, else record 0.
3. Repeat step 1 with the result of the previous multiplication and then step 2, until the fractional part becomes 0. in case of infinite calculations, generally 6 digits are taken.

Converting Binary, Octal and Hexadecimal to Decimal

The method used for conversion of a binary, octal and hexadecimal number to decimal number involves each digit of the binary, octal or hexadecimal number to be multiplied by its weighted position, and then each of the weighted values are added to get the decimal number.

Example:

Binary Number	1	1	0	1	0
Weight of each bit	2^4	2^2	2^2	2^1	2^0
Weghted Value	$2^4 * 1$	$2^3 * 1$	$2^2 * 0$	$2^1 * 1$	$2^0 * 0$
Solved Multiplication	16	8	0	2	0

Sum of weight of all bits = 16 + 8 +0 + 2 + 0 = 26

Thus, the decimal equivalent of $(11010)_2$ is $(26)_{10}$

Converting Between Octal and Hexadecimal

Steps of conversion

1. Convert each octal digit to 3-bit binary form
2. Combine all the 3-bit binary numbers.
3. Segregate the binary numbers into 4-bit binary form by starting the first

number from the right bit (LSB) towards the number on the left bit (MSB).
4. Finally, convert these 4-bit blocks into their respective hexadecimal symbols.

ASSESSMENT

1. A single unit which is composed of small group of bits is known as
   (a) bit
   (b) bug
   (c) flag
   (d) byte
2. BCD stands for
   (a) Binary Coded Decimal
   (b) Binary Coded Digitals
   (c) Binary Characters Decimals
   (d) Binary Conducting Decimals
3. System in which fractions are written by extending binary rotation is called
   (a) fixed-point representation
   (b) floating-point representation
   (c) binary digits representation
   (d) single rotation representation
4. 'megabytes' of computer storage capacity consists of
   (a) one million bytes
   (b) two million bytes
   (c) three million bytes
   (d) four million bytes
5. In BCD code, maximum possible characters set size is
   (a) character set of 64
   (b) character set of 84
   (c) character set of 94
   (d) character set of 104

ANSWERS

1. d
2. a
3. a
4. a
5. a

WEEK 5

Computer Science SS3 Second Term

Topic: Security and Ethics

Computer Ethics

Computer Ethics can be defined as a set of moral principle that requires the use of computer. It deals with how computer professional should make decision regarding professionals and social conduct.

Computer ethics are rules that govern the use of a computer system. **Ethics** deals with placing a "**value**" on acts according to whether they are "**good**" or "**bad**". Every society has its rules about whether certain acts are ethical or not. These rules have been established as a result of consensus in society and are often written into laws. Computer ethics are increasingly becoming important because of the rising number of cyber crime issues, including software piracy, unauthorized access, pornography, spamming, target marketing, and hacking. The widespread popularity and use of the Internet has given rise to a number of cybercrime issues and concerns about user privacy. Various computing applications are tampered with to invade into other's privacy. Malware, spyware, freeware, and browser cookie exploits are some of the notorious computing applications that have spurred the debate of importance of ethical behavior in technology.Some of the rules you should follow while using computer are:

BASIC RULES

- Check your email regularly
- Avoid liquid and moist from dropping into the computer system
- Protect the system from power fluctuation
- Unplug the system when not in use
- Respond to email promptly and politely
- Use dust cover or proof to cover the system after use

GENERAL RULES

- Any restricted files stardom the computer should not be accessed
- You should not give your user name and password to any one
- You should not alter any information on the system except your own
- Be polite to others on the net
- Be careful not to use rude or bad language online
- Do not break any laws
- Be patients with new comers
- Your message should be simple on the point.

Security Breaches

- Unintentional intrusions
- Intentional attacks
- Denial of services attacks
- Making services not available (e.g. over the Internet)
- Browsing
- Directory or data in memory
- Disk from previous process file
- Wire tapping
- Listening and collecting information (e.g. passwords for later access) bypassing authentication
- Repeated trials (guessing authentic passwords)
- Trap doors (including backdoor passwords)
- Unspecified and undocumented entry points to systems
- Trash collection / dumpster diving

Virus – Security Breach

- a small program that alters the way a computer operates without the permission or knowledge of the user
- Self-executing – often placing its own code in the path of another

- Self-replicating – accomplished by copying itself from an infected file to a clean file
- Targeting certain OS exploiting known vulnerability in the system software – hence important to correctly update the OS with patches Security and Viruses and worms

Types of Virus

- File infector Normally resident in memory and infect executive files in the OS
- Boot sector Infect the boot sector (disks and hard drives) when the computer is booted up (powered on)
- Master boot record Infect the boot record of a disk saving a legitimate copy of the master boot record in a different location on the volume
- Multipartite Infect both boot record and program files making especially difficult to repair
- Macro Infect data files such as word processing and spreadsheet Security and Viruses and worms

Trojan Horses (Security Breach)

- A virus disguised as a legitimate / harmless program
- Sometimes carries within itself the means to allow the program creator to secretly access the user system
- Replaces the standard login with an identical fake login to capture the keystrokes
- The user sees a login prompt and types in user ID
- The user sees a password prompt and type in password
- The rogue program records user ID and password and send a typical login failure message to the user, and returns to legitimate program
- Now the user see the legitimate login and types in user ID
- The user then sees the legitimate password prompt and types in password

- Finally the user gains access, unaware that the ID and password were stored by the rogue program

Bombs (Security Breach)

- A logic bomb is a destructive program with a fuse – triggering event (e.g. keystroke or Internet connection).
- A logic bomb often spreads unnoticed throughout a network until a predetermined event when it goes off and does the damage.
- A time bomb is triggered by a specific time such as a day of the year. Example – Michaelangelo discovered in 1991 was designed to execute on the birthday of Michaelangelo (6 March 1475) when a computer is booted up. It overwrote the first 17 sectors on heads 0-3 of the first 256 tracks of the disk making subsequent boot difficult.

Antivirus software is capable of repairing files infected with a virus but it is generally unable to repair worms.

ASSESSMENT

1. What are computer ethics?
   (a) An honest, moral code that should be followed when on the computer
   (b) A computer program about honesty
   (c) A computer that fits on or under a desk
   (d) A list of commandments in the Bible
2. Which of the following would be considered as a way that a computer virus can enter a computer system?
   (a) E-mail and file attachments.
   (b) Downloaded copies of games
   (c) Downloaded copies of shareware
   (d All of the above.
3. The unauthorized use of private and confidential personal information has seriously damaged the privacy of individuals. Accessing individuals' private e-mail conversations and computer records, and collecting and sharing

information about individuals gained from their visits to Internet websites and newsgroups is an example of which type of privacy violation?
(a) Personal
(b) Computer monitoring
(c) Computer
(d) none of the above

4. Computer monitoring has been praised as robbing workers of the dignity of their work because workers are forced to work at a hectic pace under poor working conditions.
(a) True
(b) False
5. Hacking is defined as the authorized access and use of networked computer systems.
(a) True
(b) False

ANSWERS

1. a
2. d
3. a
4. b
5. a