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First Year Computer Science

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Prepared by freebooks.pk — original student notes covering the Punjab Curriculum and Textbook Board (PTB/PCTB) Intermediate Computer Science (ICS) syllabus. Each chapter includes key concepts, definitions, key facts, diagrams, solved examples, short and long questions, MCQs, revision and exam tips.

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1st Year Computer Science — Punjab Board

CHAPTER 1

Basics of Information Technology

Key Concepts • Definitions • Short & Long Questions • MCQs • Diagrams • Exam Tips

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This chapter covers the Basics of Information Technology from the 1st Year (ICS Part-I) Computer Science syllabus of the Punjab Curriculum and Textbook Board (PTB/PCTB). It introduces hardware and software, input and output devices, system and application software, the basic units of data storage and the system development life cycle. These notes are prepared by freebooks.pk.

Information technology (IT) is the use of computers to store, process and communicate information. This chapter builds the foundation by explaining what a computer is made of and how its parts work together.

Learning Objectives

- Distinguish between hardware and software.
- Identify common input and output devices.
- Differentiate system software from application software.
- State the basic units of data storage.
- Describe a system and the stages of the system development life cycle.

Key Concepts

Hardware and Software

A computer system is made up of two parts: hardware and software. Hardware is the collection of all the physical (touchable) components of the computer, such as the keyboard, mouse, monitor, processor, memory and printer. Software is the set of instructions, called programs, that tell the hardware what to do; it cannot be touched. Hardware and software depend on each other: hardware without software is like a body without life, and software cannot work without hardware to run it.

Input Devices

An input device is any hardware used to enter data and instructions into the computer. The most common are the keyboard, used to type text and commands, and the mouse, a pointing device used to select and move items on the screen. Other input devices include scanning devices such as the optical scanner, barcode reader, optical mark reader (OMR) and optical character reader (OCR), which read printed information directly, and audio/video input devices such as the microphone and digital camera, which capture sound and images.

Output Devices

An output device is any hardware that presents the results (information) produced by the computer to the user. The monitor (or visual display unit) shows output on a screen as soft copy, while the printer produces output on paper as hard copy; common printers include the dot-matrix, inkjet and laser printer. The speaker gives sound output, and the plotter is used to print large drawings and maps. Output can therefore be seen, heard or printed.



System Software and Application Software

Software is broadly of two kinds. System software controls and manages the operation of the computer itself and provides a platform for other programs; it includes the operating system (such as Windows), utility programs (which perform maintenance tasks like virus scanning and disk cleanup) and language translators (which convert program code into machine language). Application software is written to help the user carry out a particular task, and may be general-purpose (such as a word processor or spreadsheet used by many people) or custom (special-purpose) software made for one organisation, such as a bank's accounts system.

Basic Units of Data Storage

Inside a computer all data is represented using only two digits, 0 and 1, called binary digits or bits. A bit is the smallest unit of data. A group of 8 bits makes one byte, which can store a single character such as a letter or digit. Larger amounts of storage are measured in kilobytes (KB), megabytes (MB), gigabytes (GB) and terabytes (TB), where each unit is 1024 times the one before it. A word is the number of bits (such as 16, 32 or 64) that the processor can handle as a single unit at one time.

What is a System?

A system is a group of components that work together to achieve a common goal. A computer-based information system has several parts: hardware, software, data, people (users) and procedures. These components interact so that raw data given as input is processed into useful information as output. Understanding a system as a set of cooperating parts is the first step towards designing and building software for real problems.

System Development Life Cycle

The system development life cycle (SDLC) is the step-by-step process used to plan, build and maintain an information system. Its main stages are: identifying the problem, carrying out a feasibility study, analysing the requirements, designing the system, developing (coding) it, testing it, implementing (installing) it and finally maintaining it. Following these stages in order helps ensure that the finished system is reliable, meets the users' needs and can be improved over time.

Important Definitions

Term	Definition
Hardware	The physical, touchable components of a computer.
Software	The set of programs (instructions) that tell the hardware what to do.
Input device	Hardware used to enter data and instructions into the computer.
Output device	Hardware that presents the computer's results to the user.
System software	



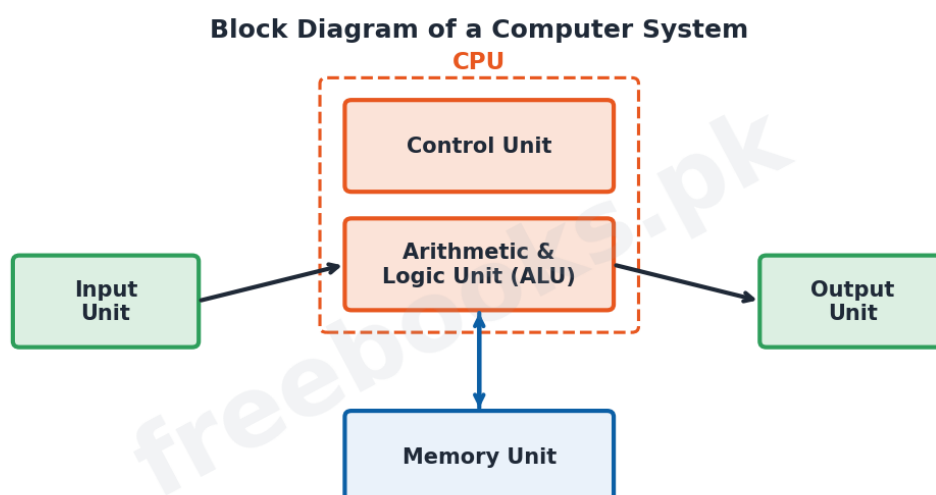
Term	Definition
	Software that controls and manages the computer (e.g. the operating system).
Application software	Software written to perform a particular task for the user.
Bit	A binary digit, 0 or 1; the smallest unit of data.
Byte	A group of 8 bits that stores one character.

Key Facts & Rules

Item	Detail
Bit	Smallest unit of data (0 or 1)
1 Byte	8 bits (stores one character)
1 Kilobyte (KB)	1024 bytes
1 Megabyte (MB)	1024 KB
1 Gigabyte (GB)	1024 MB
1 Terabyte (TB)	1024 GB
Word	Bits the CPU handles at once (16/32/64-bit)

Diagrams & Illustrations

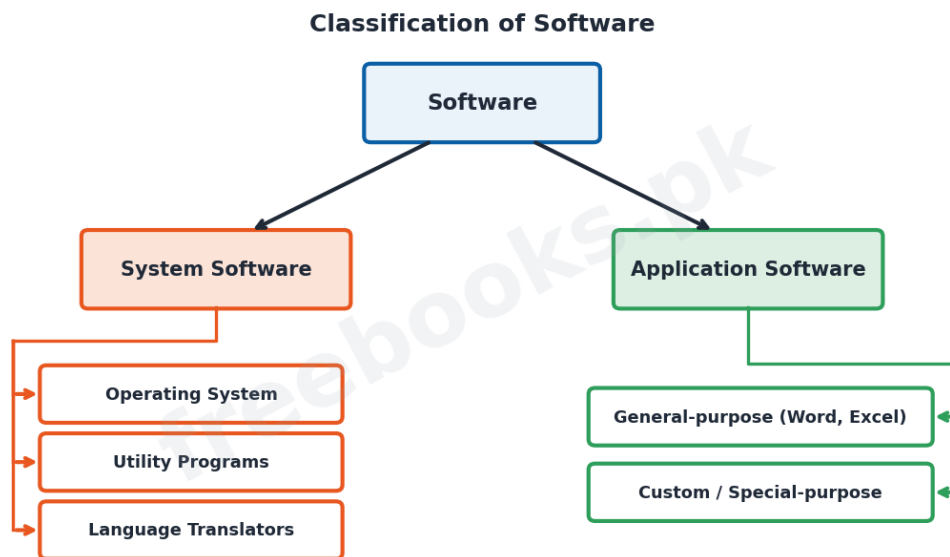
Block diagram of a computer: a computer system showing the input unit feeding the CPU (control unit + ALU) which works with the memory unit and sends results to the output unit.



Block diagram of a computer



Classification of software: a tree splitting software into system software (operating system, utility programs, language translators) and application software (general-purpose and custom).

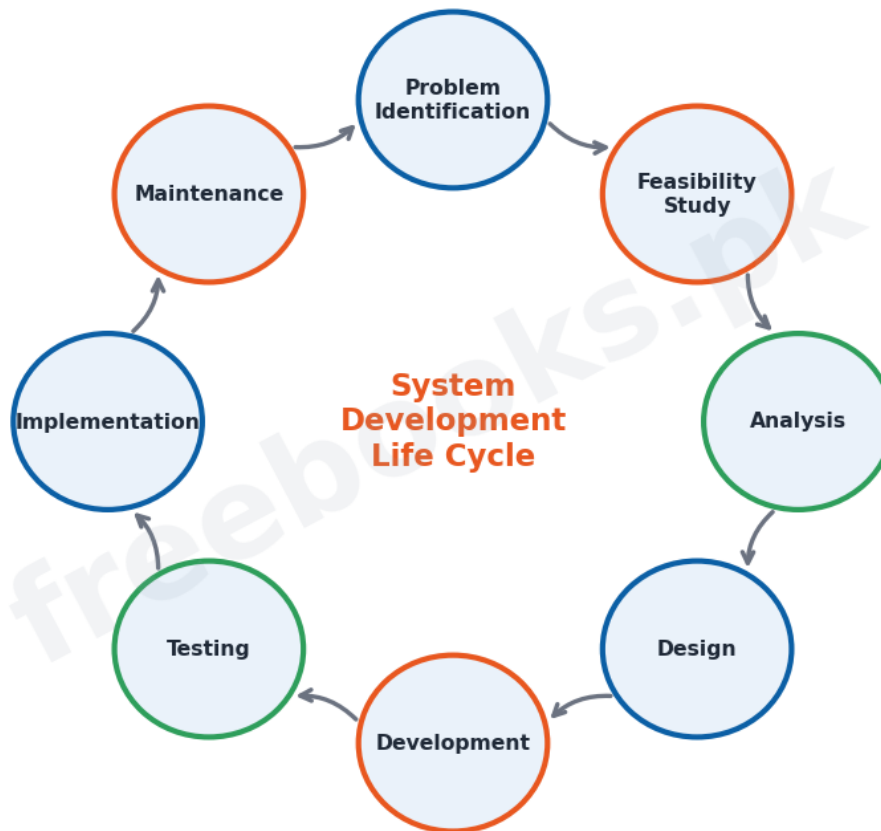


Classification of software

System development life cycle: the SDLC shown as a cycle of stages from problem identification and feasibility through analysis, design, development, testing, implementation and maintenance.



System Development Life Cycle (SDLC)



System development life cycle

Solved Examples & Practice

Bytes in a kilobyte

How many bytes are in 2 KB? $2 \text{ KB} = 2 \times 1024 = 2048$ bytes.

Bits in a byte

A byte stores one character using 8 bits, so the word 'CAT' (3 characters) needs 3 bytes = 24 bits.

Classify a device

A laser printer is an output device (hard copy), while a barcode reader is an input (scanning) device.

Classify software

MS Word is application software (general-purpose), whereas Windows is system software (an operating system).



Short Questions & Answers

Q1. Differentiate between hardware and software.

Ans. Hardware is the physical, touchable parts of a computer; software is the set of programs (instructions) that tell the hardware what to do and cannot be touched.

Q2. What is an input device? Give two examples.

Ans. A device used to enter data and instructions into the computer; examples are the keyboard and the mouse.

Q3. What is the difference between soft copy and hard copy?

Ans. Soft copy is output shown on the monitor screen; hard copy is output printed on paper.

Q4. Differentiate system software and application software.

Ans. System software manages and runs the computer (e.g. the operating system); application software performs a specific task for the user (e.g. a word processor).

Q5. What is a byte?

Ans. A group of 8 bits, which can store a single character such as a letter or digit.

Q6. What is the system development life cycle?

Ans. The step-by-step process of planning, building, testing, implementing and maintaining an information system.

Long Questions & Answers

Q1: Define hardware and software and explain, with examples, the input and output devices of a computer.

A computer system consists of two complementary parts, hardware and software. Hardware is the term for all the physical components of the computer, that is, the parts that can be seen and touched, such as the keyboard, mouse, monitor, processor, memory chips and printer. Software, on the other hand, is the collection of programs, or sets of instructions, that direct the hardware to perform useful work; software has no physical form and cannot be touched. The two are completely dependent on one another, since hardware can do nothing without software to instruct it, and software cannot run without hardware to execute it. Among the hardware, the devices used to feed information into the computer are called input devices. The keyboard is used to type text, numbers and commands, and the mouse is a pointing device used to select, move and open items on the screen. Other input devices include scanning devices such as optical scanners, barcode readers, optical mark readers (OMR) and optical character readers (OCR), which read printed data directly, and audio/video devices such as microphones and digital cameras, which capture sound and pictures. The devices that deliver the computer's results back to the user are called output devices. The monitor displays output on its screen as a temporary soft copy, while printers such as the dot-matrix, inkjet and laser printer produce a permanent hard copy on paper; speakers provide sound output and plotters print large drawings. Thus input devices carry data into the machine and output devices carry information out of it.



Q2: Explain the classification of software into system software and application software.

All computer software falls into two broad categories according to the purpose it serves: system software and application software. System software is the software that controls, manages and runs the computer hardware itself and provides an environment in which other programs can operate. The most important piece of system software is the operating system, such as Windows, which manages the memory, files, devices and running programs and acts as the bridge between the user and the hardware. System software also includes utility programs, which carry out housekeeping and maintenance tasks such as scanning for viruses, cleaning up the disk, and compressing files, and language translators (assemblers, compilers and interpreters), which convert the programs written by programmers into the machine language that the computer can execute. Application software, by contrast, is written to help the user perform a specific real-world task rather than to run the computer. It is itself of two kinds: general-purpose (packaged) software, such as word processors, spreadsheets and web browsers, which is produced for and used by very large numbers of people, and custom or special-purpose software, which is developed to meet the particular needs of a single organisation, for example a bank's account-management program or an airline's reservation system. In short, system software makes the computer work, while application software makes the computer useful for a job.

Q3: Describe what is meant by a system and explain the stages of the system development life cycle.

In computing, a system is a set of related components that work together in an organised way to achieve a common purpose. A computer-based information system is made up of hardware, software, data, people (the users) and procedures, all of which cooperate so that raw data supplied as input is processed into meaningful information delivered as output. When a new information system is needed, it is not built at random but developed through an orderly sequence of stages known as the system development life cycle (SDLC). The first stage is problem identification, in which the need or problem is recognised and defined. This is followed by a feasibility study, which checks whether the proposed system is technically and economically worthwhile. Next comes analysis, where the exact requirements of the users are gathered and studied, and then design, in which the structure of the new system, its inputs, outputs, files and processes, is planned. In the development stage the design is turned into actual programs by coding, after which the system is thoroughly tested to find and remove errors. Once it works correctly it is implemented, that is, installed and put into use, and the users are trained. Finally, in the maintenance stage the working system is monitored, corrected and improved over its lifetime as needs change. Carrying out these stages in order helps produce a reliable system that genuinely meets the users' needs and can be enhanced later.

MCQs with Answers

1. The physical parts of a computer are called:



(a) software (b) hardware (c) firmware (d) freeware

Correct Answer: (b) hardware. Hardware (touchable parts).

2. Which of the following is an input device?

(a) monitor (b) printer (c) keyboard (d) speaker

Correct Answer: (c) keyboard. The keyboard.

3. Which of the following is an output device?

(a) mouse (b) scanner (c) monitor (d) microphone

Correct Answer: (c) monitor. The monitor.

4. The smallest unit of data is the:

(a) byte (b) bit (c) word (d) nibble

Correct Answer: (b) bit. The bit (0 or 1).

5. One byte is equal to:

(a) 4 bits (b) 8 bits (c) 16 bits (d) 1024 bits

Correct Answer: (b) 8 bits. 8 bits.

6. 1 Kilobyte equals:

(a) 1000 bytes (b) 1024 bytes (c) 8 bytes (d) 1024 bits

Correct Answer: (b) 1024 bytes. 1024 bytes.

7. Windows is an example of:

(a) application software (b) system software (c) hardware (d) a printer

Correct Answer: (b) system software. System software (an operating system).

8. A word processor is an example of:

(a) system software (b) application software (c) an input device (d) an OS

Correct Answer: (b) application software. Application software.

9. A barcode reader is a type of:

(a) output device (b) scanning input device (c) printer (d) memory

Correct Answer: (b) scanning input device. A scanning input device.

10. The correct order of some early SDLC stages is:

(a) design, analysis, problem (b) problem, analysis, design (c) testing, design, problem
(d) design, problem, analysis

Correct Answer: (b) problem, analysis, design. Problem identification, then analysis, then design.

Quick Revision Summary

- Hardware = physical parts; software = programs (instructions); they depend on each other.
- Input devices: keyboard, mouse, scanners (OMR/OCR/barcode), mic, camera.
- Output devices: monitor (soft copy), printer (hard copy), speaker, plotter.
- System software (OS, utilities, translators) vs application software (general-purpose / custom).



- Data units: bit -> byte (8 bits) -> KB -> MB -> GB -> TB (x1024 each); word = CPU bits at once.
- System = cooperating parts; SDLC: problem, feasibility, analysis, design, development, testing, implementation, maintenance. Notes by freebooks.pk.

Exam Tips

- Clearly state hardware = touchable, software = instructions.
- Be able to classify any given device as input or output.
- Learn the storage units in order with x1024 between them.
- Give examples: OS/utility/translator (system) vs Word/Excel (application).
- Memorise the SDLC stages in the correct order.
- Use everyday examples (printer, keyboard) in answers.

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CHAPTER 2

Information Networks

Key Concepts • Definitions • Short & Long Questions • MCQs • Diagrams • Exam Tips

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This chapter covers Information Networks from the 1st Year (ICS Part-I) Computer Science syllabus of the Punjab Curriculum and Textbook Board (PTB/PCTB). It explains workgroup computing, e-mail, the Internet, the components of a network, LAN, WAN and MAN, network models, standards, topologies and the OSI model. These notes are prepared by freebooks.pk.

A network connects computers so that they can share data and resources. Networks make e-mail, the Internet and shared printers possible, and this chapter explains how they are built and organised.

Learning Objectives

- Explain workgroup computing and the benefits of e-mail.
- Describe the Internet and its usefulness.
- List the components of a network.
- Distinguish LAN, MAN and WAN.
- Describe network models, standards and topologies.
- Outline the OSI model.

Key Concepts

Workgroup Computing and E-mail

Workgroup computing means a number of people connected by a network working together on the same task, sharing files, printers and information. One of the most useful network services is electronic mail (e-mail), which lets users send and receive messages, documents and files almost instantly to anyone in the world. The benefits of e-mail include speed, low cost, the ability to send the same message to many people at once, and a written record of the communication.

The Internet

The Internet is a worldwide network of networks that connects millions of computers so that they can share information. It grew out of a research project (ARPANET) and has become a global system used for communication, research, business, entertainment and education. Through the Internet users can browse the World Wide Web, send e-mail, download files and use countless online services.

Components of a Network

A computer network is built from several components working together: the computers (servers and clients) themselves, the transmission media (cables or wireless links) that carry the data, network interface cards (NICs) that connect each computer to the media, and connecting devices such as hubs, switches and routers that direct the traffic. Network software (a network operating system) manages the communication and controls access to shared resources.



LAN, MAN and WAN

Networks are classified by the area they cover. A local area network (LAN) connects computers within a small area such as a single building, office or school. A metropolitan area network (MAN) covers a larger area such as a city. A wide area network (WAN) spans a very large area, such as a country or the whole world; the Internet is the largest WAN. As the area grows, so does the size and complexity of the network.

Network Models

There are two main ways of organising a network. In a peer-to-peer network all the computers are equal and can share their resources directly with one another, which is simple and cheap but suited only to small networks. In a client-server network one or more powerful computers, called servers, provide services and resources (files, printing, e-mail) to the other computers, called clients; this model is more secure and better for large networks.

Network Topologies

The topology of a network is the physical arrangement in which its computers are connected. In a bus topology all computers share a single central cable. In a star topology every computer is connected to a central hub or switch. In a ring topology the computers are joined in a closed loop, and data passes around the ring. In a mesh topology every computer is connected to every other. Each topology has its own advantages in cost, reliability and ease of fault-finding.

Network Standards and the OSI Model

For different computers and devices to communicate, they must follow agreed rules called protocols and standards. The Open Systems Interconnection (OSI) model is a standard reference model that divides network communication into seven layers, from the physical layer (the actual cabling and signals) at the bottom, through the data link, network, transport, session and presentation layers, up to the application layer (the programs the user works with) at the top. Each layer performs a specific function and passes data to the layer above or below it, which makes networks easier to design and troubleshoot.

Important Definitions

Term	Definition
Network	Two or more computers connected to share data and resources.
E-mail	Electronic mail; sending messages and files over a network.
Internet	A worldwide network of networks connecting millions of computers.
LAN	A local area network covering a small area such as a building.
WAN	A wide area network covering a very large area such as a country.
Topology	The physical arrangement of computers in a network.
Protocol	A set of rules that governs communication between devices.



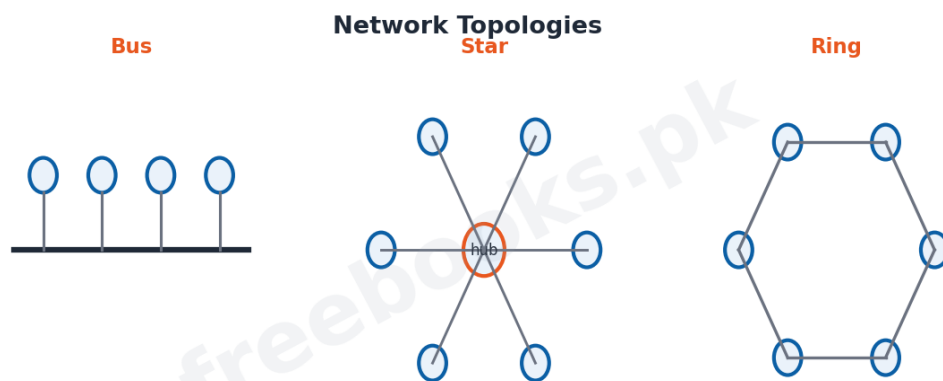
Term	Definition
OSI model	A seven-layer reference model for network communication.

Key Facts & Rules

Item	Detail
LAN	Small area (building / office)
MAN	City-sized area
WAN	Country or worldwide (e.g. the Internet)
Peer-to-peer	All computers equal; small networks
Client-server	Servers provide resources to clients; large networks
OSI layers	Physical, Data Link, Network, Transport, Session, Presentation, Application

Diagrams & Illustrations

Network topologies: the bus, star and ring topologies showing how computers are connected by a shared cable, a central hub and a closed loop respectively.



Network topologies

Types of networks: LAN, MAN and WAN shown by increasing area, from a single building to a city to a country/worldwide.



Types of Networks by Area

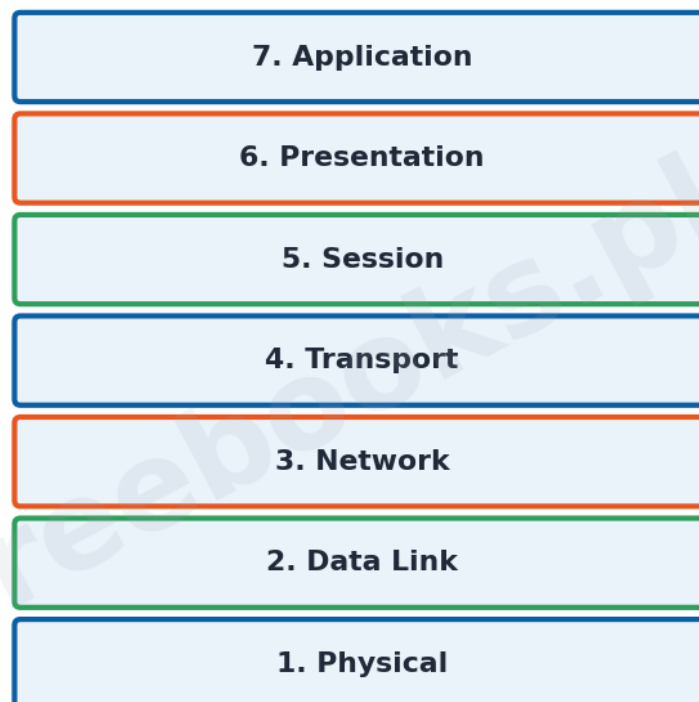


Networks grow in size: LAN < MAN < WAN

Types of networks

OSI model: the seven layers of the OSI model from the physical layer at the bottom to the application layer at the top.

OSI Model (7 Layers)



OSI model



Solved Examples & Practice

Choosing a network type

A school connecting the computers in one building would use a LAN; a bank linking branches across the country would use a WAN.

Choosing a model

A home with three computers sharing a printer can use a peer-to-peer network; a company with hundreds of users needs a client-server network.

Identifying a topology

If every computer is joined to a central hub, the topology is a star; if they all share one long cable, it is a bus.

Counting OSI layers

The OSI model has 7 layers; the lowest is the physical layer and the highest is the application layer.

Short Questions & Answers

Q1. What is a computer network?

Ans. Two or more computers connected together so that they can share data and resources.

Q2. State two benefits of e-mail.

Ans. It is fast and cheap, and one message can be sent to many people at once with a written record kept.

Q3. Differentiate between LAN and WAN.

Ans. A LAN covers a small area such as a building; a WAN covers a very large area such as a country or the world.

Q4. Differentiate peer-to-peer and client-server networks.

Ans. In peer-to-peer all computers are equal and share directly; in client-server, servers provide resources to client computers.

Q5. What is a network topology?

Ans. The physical arrangement in which the computers of a network are connected (e.g. bus, star, ring).

Q6. How many layers has the OSI model and name the lowest and highest.

Ans. Seven layers; the lowest is the physical layer and the highest is the application layer.



Long Questions & Answers

Q1: Describe the components of a network and distinguish between LAN, MAN and WAN.

A computer network is made up of several components that work together to let computers communicate and share resources. First there are the computers themselves, which may act as servers (providing resources) or clients (using them). The data travels over transmission media, which may be cables such as twisted-pair, coaxial or fibre-optic, or wireless links such as radio waves. Each computer connects to the media through a network interface card (NIC). Connecting devices such as hubs, switches and routers join the parts of the network together and direct the data to the correct destination. Finally, network software, usually a network operating system, manages communication and controls who may use the shared resources. Networks are classified according to the geographical area they cover. A local area network (LAN) links computers within a small area such as one building, office or school, and is usually owned by a single organisation. A metropolitan area network (MAN) is larger, covering a city or town, and often links several LANs together. A wide area network (WAN) covers a very large area such as a country or even the whole world; it uses long-distance links, often provided by telephone and satellite companies, and the Internet is the biggest example of a WAN. Thus as we move from LAN to MAN to WAN the area covered, and usually the number of computers and the complexity, increase.

Q2: Explain the common network topologies and their advantages.

The topology of a network describes the physical layout, that is, the way in which its computers and cables are arranged and connected. In a bus topology, all the computers are attached to a single main cable called the bus; it is cheap and easy to set up and uses little cable, but if the main cable fails the whole network stops working, and it is slow when traffic is heavy. In a star topology, each computer is connected by its own cable to a central device such as a hub or switch; this makes the network reliable because a fault in one cable affects only one computer, and faults are easy to find, though it needs more cable and depends on the central device. In a ring topology, the computers are connected one after another to form a closed loop, and data passes around the ring from one computer to the next in one direction; it gives each computer a fair chance to send data but a break in the ring can stop the whole network. In a mesh topology, every computer is directly connected to every other computer, which is very reliable because there are many alternative paths, but it is expensive and complex because of the large number of connections. The choice of topology depends on the cost, the required reliability and how easy the network must be to expand and repair.

Q3: Describe the OSI model and explain why network standards are important.

For computers and devices made by different manufacturers to communicate successfully over a network, they must all obey the same agreed rules, called protocols and standards. Without such standards, equipment from different companies would be unable to work



together. The most important reference standard is the Open Systems Interconnection (OSI) model, developed by the International Standards Organisation, which describes network communication as a stack of seven layers, each with a clearly defined job. From the bottom upwards these are: the physical layer, which deals with the actual cables, connectors and electrical signals; the data link layer, which organises data into frames and handles error detection between directly connected devices; the network layer, which is responsible for addressing and routing data across the network; the transport layer, which ensures reliable, complete delivery of data; the session layer, which sets up and manages connections between applications; the presentation layer, which translates, encrypts and compresses data into a form the application can use; and finally the application layer, which provides the network services that the user's programs, such as web browsers and e-mail, actually use. When data is sent, it passes down through the layers of the sending computer and up through the layers of the receiving computer, each layer adding or removing its own control information. Dividing the task into layers in this way makes networks much easier to design, understand and troubleshoot, because each layer can be developed and repaired independently of the others.

MCQs with Answers

1. Electronic mail is commonly called:

- (a) e-post (b) e-mail (c) e-file (d) e-net

Correct Answer: (b) e-mail. E-mail.

2. A network covering a single building is a:

- (a) WAN (b) MAN (c) LAN (d) Internet

Correct Answer: (c) LAN. A LAN.

3. The largest example of a WAN is the:

- (a) LAN (b) hub (c) Internet (d) NIC

Correct Answer: (c) Internet. The Internet.

4. In a client-server network, resources are provided by the:

- (a) client (b) server (c) hub (d) cable

Correct Answer: (b) server. The server.

5. A topology where all computers connect to a central hub is:

- (a) bus (b) star (c) ring (d) mesh

Correct Answer: (b) star. Star.

6. A topology where computers share one main cable is:

- (a) star (b) bus (c) ring (d) mesh

Correct Answer: (b) bus. Bus.

7. A card that connects a computer to the network is the:

- (a) CPU (b) NIC (c) ALU (d) RAM

Correct Answer: (b) NIC. The network interface card (NIC).

8. The OSI model has ___ layers:



(a) five (b) six (c) seven (d) eight

Correct Answer: (c) seven. Seven.

9. The lowest layer of the OSI model is the:

(a) application (b) physical (c) network (d) session

Correct Answer: (b) physical. Physical.

10. A set of rules for communication is called a:

(a) topology (b) protocol (c) server (d) modem

Correct Answer: (b) protocol. A protocol.

Quick Revision Summary

- Network = connected computers sharing data/resources; e-mail is fast, cheap, one-to-many.
- Internet = worldwide network of networks (largest WAN).
- Components: computers, media, NIC, hubs/switches/routers, network software.
- By area: LAN (building) < MAN (city) < WAN (country/world).
- Models: peer-to-peer (equal) vs client-server (servers provide resources).
- Topologies: bus, star, ring, mesh. OSI = 7 layers (Physical -> Application). Notes by freebooks.pk.

Exam Tips

- Learn LAN/MAN/WAN by the area they cover.
- State two clear benefits of e-mail.
- Compare peer-to-peer and client-server networks.
- Draw and label the bus, star and ring topologies.
- Memorise the 7 OSI layers in order (Physical at the bottom).
- Define protocol and why standards matter.

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CHAPTER 3

Data Communications

Key Concepts • Definitions • Short & Long Questions • MCQs • Diagrams • Exam Tips

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This chapter covers Data Communications from the 1st Year (ICS Part-I) Computer Science syllabus of the Punjab Curriculum and Textbook Board (PTB/PCTB). It explains the components of a data communication system, signals, modes and types of data transmission, bandwidth, communication media and the modem. These notes are prepared by freebooks.pk.

Data communication is the transfer of data from one device to another through some transmission medium. It is the foundation of every network, and this chapter explains how data actually travels between computers.

Learning Objectives

- List the components of a data communication system.
- Distinguish analog and digital signals.
- Describe the modes of data communication.
- Distinguish serial and parallel transmission.
- Define bandwidth and describe the communication media.
- Explain the purpose of a modem.

Key Concepts

Components of Data Communication

A data communication system has five basic components. The sender (source) is the device that sends the data; the receiver (destination) is the device that receives it; the message is the information (data) being communicated; the transmission medium is the physical path (cable or wireless) along which the message travels; and the protocol is the set of agreed rules that both devices follow so that communication is successful. All five must be present for data to be exchanged correctly.

Signals: Analog and Digital

Data is carried by signals. An analog signal varies smoothly and continuously, like the human voice or a sine wave, taking any value within a range. A digital signal has only a few discrete levels, usually two, representing the 0s and 1s used by computers. Computers work with digital signals, but some transmission media (such as ordinary telephone lines) were designed for analog signals, which is why conversion is sometimes needed.

Data Representation and Encoding

Inside a computer, data such as letters, digits and symbols is represented using binary codes. A common coding scheme is ASCII (American Standard Code for Information Interchange), in which each character is given a unique 7- or 8-bit binary code. Encoding is the process of converting data into a particular pattern of signals suitable for transmission, and decoding is converting it back at the receiver.



Modes of Data Communication

The direction in which data can flow between two devices gives three modes. In simplex mode data flows in one direction only (for example from a keyboard to the computer). In half-duplex mode data can flow in both directions but only one direction at a time (like a walkie-talkie). In full-duplex mode data can flow in both directions at the same time (like a telephone call). Full-duplex allows the fastest two-way communication.

Types of Data Transmission

Data can be transmitted in two ways according to how the bits are sent. In serial transmission the bits of a byte are sent one after another over a single wire, which is cheaper and used over long distances. In parallel transmission several bits are sent at the same time over several wires, which is faster but used only over short distances (such as inside the computer). Transmission may also be asynchronous (one character at a time with start and stop bits) or synchronous (a steady stream of characters kept in step by a clock).

Bandwidth and Communication Media

Bandwidth is the amount of data that a communication channel can carry in a given time, usually measured in bits per second (bps); a higher bandwidth means faster data transfer. The transmission media are of two kinds. Guided (wired) media carry the signal along a physical cable and include twisted-pair cable, coaxial cable and fibre-optic cable (the fastest, using light). Unguided (wireless) media carry the signal through the air and include radio waves, microwaves and satellite communication.

The Modem

A modem (from modulator-demodulator) is a device that lets a computer send and receive data over analog lines such as telephone lines. At the sending end it modulates, converting the computer's digital signals into analog signals that the line can carry; at the receiving end another modem demodulates, converting the analog signals back into digital form for the receiving computer. Modems may be internal (fitted inside the computer) or external (a separate box).

Important Definitions

Term	Definition
Data communication	The transfer of data between devices through a transmission medium.
Protocol	The set of rules that governs a data communication.
Analog signal	A continuously varying signal that can take any value in a range.
Digital signal	A signal with discrete levels representing 0s and 1s.
Simplex	Data flows in one direction only.
Full-duplex	Data flows in both directions at the same time.
Bandwidth	The data-carrying capacity of a channel, in bits per second.



Term	Definition
Modem	A device that converts digital to analog and back for transmission.

Key Facts & Rules

Item	Detail
Components	Sender, Receiver, Message, Medium, Protocol
Simplex	One direction only
Half-duplex	Both directions, one at a time
Full-duplex	Both directions at once
Serial	Bits one after another (long distance)
Parallel	Several bits together (short distance)
Bandwidth unit	bits per second (bps)

Diagrams & Illustrations

Data communication system: a data communication system with a sender, transmission medium and receiver, exchanging a message under an agreed protocol.

Components of a Data Communication System



Also needs an agreed protocol (rules)

Data communication system

Modes of communication: the simplex, half-duplex and full-duplex modes showing the direction(s) in which data can flow between two devices.



Modes of Data Communication

Simplex (one direction only)



Half-Duplex (one direction at a time)



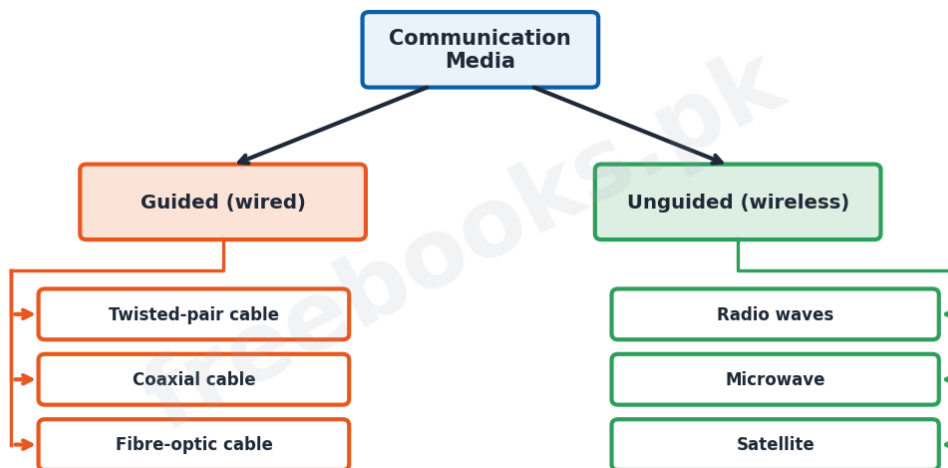
Full-Duplex (both directions at once)



Modes of communication

Communication media: communication media split into guided (twisted-pair, coaxial, fibre-optic) and unguided (radio, microwave, satellite).

Communication Media



Communication media

Solved Examples & Practice

Identify the mode

A television broadcast sends data in one direction only, so it uses simplex mode; a telephone call is full-duplex.



Serial vs parallel

Sending data across a city over one line is serial; sending 8 bits at once between the CPU and memory inside a computer is parallel.

Bandwidth

If a channel carries 2000 bits every second, its bandwidth is 2000 bps (2 kbps).

Why a modem

A home computer connecting through a telephone line needs a modem to convert its digital signals to analog and back.

Short Questions & Answers

Q1. List the components of a data communication system.

Ans. Sender, receiver, message, transmission medium and protocol.

Q2. Differentiate analog and digital signals.

Ans. An analog signal varies continuously and can take any value; a digital signal has only discrete levels representing 0s and 1s.

Q3. What is simplex mode?

Ans. A mode in which data can flow in one direction only, for example from a keyboard to the computer.

Q4. Differentiate serial and parallel transmission.

Ans. In serial transmission bits are sent one after another over one wire; in parallel transmission several bits are sent together over several wires.

Q5. Define bandwidth.

Ans. The amount of data a channel can carry per second, measured in bits per second (bps).

Q6. What is the function of a modem?

Ans. It converts digital signals to analog for transmission (modulation) and analog back to digital at the receiver (demodulation).

Long Questions & Answers

Q1: Describe the components of a data communication system and the modes of communication.

Data communication is the exchange of data between two devices through some transmission medium, and for it to work a data communication system must have five basic components. The sender, or source, is the device that generates and sends the data, such as a computer. The receiver, or destination, is the device that receives the data. The message is the actual information being sent, which may be text, numbers, pictures or sound. The transmission medium is the physical path along which the message travels from sender to



receiver, and it may be a wire such as a cable or a wireless link through the air. The protocol is the set of agreed rules that both the sender and the receiver follow so that the data is understood correctly; without a common protocol, two devices could not communicate even if they were connected. The direction in which data flows between the two devices defines the mode of communication, of which there are three. In simplex mode data can travel in one direction only, as from a keyboard to a computer or from a computer to a monitor. In half-duplex mode data can travel in both directions but only one direction at a time, as with a walkie-talkie where one person speaks while the other listens. In full-duplex mode data can travel in both directions simultaneously, as in a telephone conversation where both people can speak at once; full-duplex therefore allows the fastest and most natural two-way communication.

Q2: Explain the communication media used in data communication.

The transmission medium is the physical channel that carries data from the sender to the receiver, and the media used are of two broad kinds: guided (wired) media and unguided (wireless) media. Guided media carry the signal along a solid physical path. Twisted-pair cable consists of pairs of insulated copper wires twisted together to reduce interference; it is cheap and is widely used in telephone lines and small networks, but it carries data more slowly and over shorter distances. Coaxial cable has a central copper conductor surrounded by insulation and a metal shield; it can carry more data over longer distances than twisted pair and was long used for cable television and networks. Fibre-optic cable carries data as pulses of light through very thin strands of glass; it offers extremely high bandwidth, is very fast, is immune to electrical interference and can carry signals over great distances, which is why it is now used for the backbone of large networks and the Internet. Unguided media carry the signal through the air without any cable. Radio waves are used for short- and medium-range wireless communication such as Wi-Fi and mobile phones. Microwaves travel in straight lines between towers or dishes and are used for long-distance links. Satellite communication uses satellites in orbit to relay signals over very long distances and to remote areas that cables cannot easily reach. The choice of medium depends on the required speed (bandwidth), distance, cost and whether mobility is needed.

Q3: Explain the purpose and working of a modem and the meaning of bandwidth.

Computers work with digital signals, which consist of discrete 0s and 1s, but many of the lines that were originally available for long-distance communication, such as ordinary telephone lines, were designed to carry analog signals that vary continuously. A modem, whose name comes from the words modulator and demodulator, is the device that bridges this gap and allows a computer to communicate over such analog lines. When data is sent, the modem at the sending end performs modulation, converting the digital signals produced by the computer into analog signals that the telephone line can carry. When the signal reaches the other end, the modem there performs demodulation, converting the analog signals back into the digital form that the receiving computer can understand. Because a modem is needed at each end, both computers in such a link must have one; modems may be internal, fitted on a card inside the computer, or external, housed in a separate box



connected to the computer. Closely related to communication is the idea of bandwidth, which is the capacity of a communication channel, that is, the maximum amount of data it can carry in a given time. Bandwidth is measured in bits per second (bps), and larger units such as kilobits per second (kbps) and megabits per second (Mbps) are used for faster channels. A channel with a higher bandwidth can transfer more data in the same time, so it gives faster communication; this is why fibre-optic links, with their very high bandwidth, are preferred for carrying large amounts of data quickly.

MCQs with Answers

1. How many basic components has a data communication system?

- (a) three (b) four (c) five (d) six

Correct Answer: (c) five. Five (sender, receiver, message, medium, protocol).

2. A continuously varying signal is:

- (a) digital (b) analog (c) binary (d) serial

Correct Answer: (b) analog. Analog.

3. Computers work with ___ signals:

- (a) analog (b) digital (c) radio (d) light

Correct Answer: (b) digital. Digital.

4. A walkie-talkie uses which mode?

- (a) simplex (b) half-duplex (c) full-duplex (d) serial

Correct Answer: (b) half-duplex. Half-duplex.

5. A telephone call is an example of:

- (a) simplex (b) half-duplex (c) full-duplex (d) parallel

Correct Answer: (c) full-duplex. Full-duplex.

6. Sending bits one after another over one wire is:

- (a) parallel (b) serial (c) simplex (d) duplex

Correct Answer: (b) serial. Serial transmission.

7. Bandwidth is measured in:

- (a) bytes (b) bits per second (c) hertz only (d) metres

Correct Answer: (b) bits per second. Bits per second (bps).

8. Which medium uses light to carry data?

- (a) twisted pair (b) coaxial (c) fibre-optic (d) radio

Correct Answer: (c) fibre-optic. Fibre-optic cable.

9. Radio, microwave and satellite are ___ media:

- (a) guided (b) unguided (c) wired (d) serial

Correct Answer: (b) unguided. Unguided (wireless).

10. A modem converts digital to ___ and back:

- (a) binary (b) analog (c) serial (d) light

Correct Answer: (b) analog. Analog.



Quick Revision Summary

- Components: sender, receiver, message, medium, protocol.
- Signals: analog (continuous) vs digital (0s and 1s); ASCII codes characters.
- Modes: simplex (one way), half-duplex (one at a time), full-duplex (both at once).
- Transmission: serial (one wire, long distance) vs parallel (many wires, short distance).
- Bandwidth = capacity in bps; media = guided (twisted/coaxial/fibre) + unguided (radio/microwave/satellite).
- Modem = modulator/demodulator; digital <-> analog for telephone lines. Notes by freebooks.pk.

Exam Tips

- Memorise the five components of a communication system.
- Give a real example for each mode (simplex/half/full-duplex).
- Compare serial and parallel transmission clearly.
- Define bandwidth and its unit (bps).
- Classify media into guided and unguided with examples.
- Explain modulation and demodulation for the modem.

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1st Year Computer Science — Punjab Board

CHAPTER 4

Applications and Uses of Computer

Key Concepts • Definitions • Short & Long Questions • MCQs • Diagrams • Exam Tips

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This chapter covers the Applications and Uses of Computer from the 1st Year (ICS Part-I) Computer Science syllabus of the Punjab Curriculum and Textbook Board (PTB/PCTB). It describes how computers are used in business, e-commerce, industry, CAD/CAM, simulation, medicine, airlines, education and the home, and how they simplify our work. These notes are prepared by freebooks.pk.

Computers are now used in almost every field of life. This chapter surveys the many areas where computers help people work faster, more accurately and more cheaply.

Learning Objectives

- Describe the use of computers in business and e-commerce.
- Explain the use of computers in industry, CAD and CAM.
- Describe simulation and its uses.
- Explain the use of computers in medicine, airlines and education.
- Describe the use of computers in the home.
- Explain how computers simplify our work practices.

Key Concepts

Computers in Business

Businesses use computers for many tasks that were once done by hand: keeping accounts and payroll, storing records of customers and stock in databases, preparing invoices and reports, and communicating by e-mail. Computers make these tasks faster and more accurate, reduce paperwork and allow large amounts of information to be searched and updated easily, which helps a business run efficiently and make better decisions.

E-commerce

E-commerce (electronic commerce) means buying and selling goods and services over the Internet. Customers can visit an online store, choose products, place orders and pay electronically without leaving home, and the goods are then delivered to them. E-commerce lets businesses reach customers all over the world, stay open 24 hours a day and reduce the cost of running physical shops, while giving customers convenience and a wide choice.

Industry, CAD and CAM

In industry, computers control machines and whole production lines, monitor quality and manage stock. Two important applications are CAD and CAM. Computer-aided design (CAD) uses the computer to design and draw products such as cars, buildings and machine parts accurately on screen before they are made. Computer-aided manufacture (CAM) uses computers to control the machines that actually produce the goods. Together, CAD/CAM allows products to be designed and made quickly, accurately and at lower cost.



Simulation

Simulation is the use of a computer to imitate a real situation or system so that it can be studied safely and cheaply. For example, pilots learn to fly on flight simulators, scientists model the weather, and engineers test designs before building them. Simulation lets people experiment with dangerous, expensive or impossible situations without any real risk, and it is widely used in training, research and design.

Computers in Medicine

In medicine, computers are used to keep patients' records, to run diagnostic machines such as CT and MRI scanners that produce detailed images of the body, to monitor patients in intensive care, and to control equipment during operations. Computers help doctors diagnose diseases more accurately, store and share medical information quickly, and carry out research into new treatments.

Airline and Reservation Systems

Airlines and railways use computer reservation systems to manage the booking of seats. These systems keep an up-to-date record of every flight and every seat, so that travel agents anywhere can check availability and book tickets instantly without double-booking. Computers also control air-traffic, plan routes and schedules, and handle billing, making travel safer and more efficient.

Computers in Education

In education, computers are used for computer-aided learning, in which students learn through interactive lessons, tutorials and educational software at their own pace. They are also used for research on the Internet, for preparing assignments and presentations, for online (distance) learning and examinations, and for keeping student records. Computers make learning more interesting and give access to a vast amount of information.

Computers in the Home and Simplifying Work

At home, computers are used for entertainment (games, music and films), communication (e-mail and social media), online shopping and banking, and for study and work. Household appliances such as washing machines and microwave ovens also contain small computers. In general, computers simplify our work practices by doing repetitive jobs quickly and accurately, storing and finding information easily, working without tiring, and letting people communicate and share work over networks.

Important Definitions

Term	Definition
E-commerce	Buying and selling of goods and services over the Internet.
CAD	Computer-aided design; designing products on a computer.
CAM	Computer-aided manufacture; controlling machines that make products.



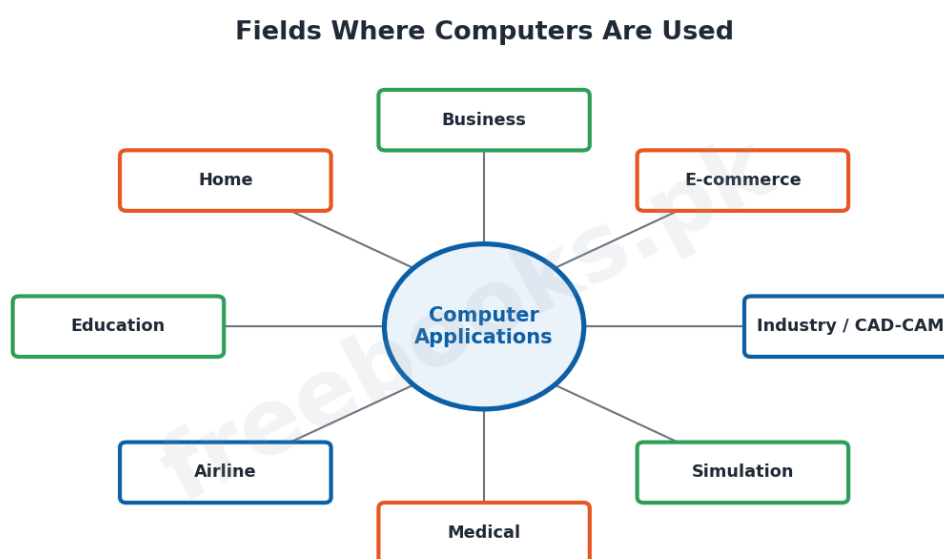
Term	Definition
Simulation	Using a computer to imitate a real situation for study or training.
Reservation system	A computer system for booking seats or tickets.
Computer-aided learning	Learning through interactive computer software.
Payroll	A computerised record used to calculate employees' pay.
Database	An organised collection of related data stored on a computer.

Key Facts & Rules

Item	Detail
Business	Accounts, payroll, records, invoices, e-mail
E-commerce	Online buying and selling
CAD	Design products on computer
CAM	Control manufacturing machines
Simulation	Imitate real systems safely (e.g. flight simulator)
Medicine	Records, scanners (CT/MRI), monitoring
Education	Computer-aided learning, research, online exams

Diagrams & Illustrations

Fields where computers are used: a central hub of computer applications surrounded by the main fields: business, e-commerce, industry/CAD-CAM, simulation, medical, airline, education and home.



Fields where computers are used



CAD and CAM: computer-aided design (CAD) producing design data that is passed to computer-aided manufacture (CAM) to make the product.

CAD and CAM



Design on computer, then manufacture with machines

CAD and CAM

E-commerce: the steps of e-commerce: a customer visits an online store, places an order, pays online and the goods are delivered.

E-commerce (buying and selling online)



E-commerce

Solved Examples & Practice

Choose the application

Designing a car body on screen before it is built uses CAD; controlling the robots that assemble it uses CAM.

Identify the use

A pilot practising landings on the ground without a real plane is using a flight simulator (simulation).

E-commerce example

Ordering a book from an online store and paying by card is an example of e-commerce.



Medicine example

An MRI scanner that produces detailed images of the body is a computer application in medicine.

Short Questions & Answers

Q1. What is e-commerce?

Ans. The buying and selling of goods and services over the Internet.

Q2. Differentiate CAD and CAM.

Ans. CAD uses the computer to design products, while CAM uses the computer to control the machines that manufacture them.

Q3. What is simulation? Give an example.

Ans. Using a computer to imitate a real situation for safe study or training, for example a flight simulator.

Q4. Give two uses of computers in medicine.

Ans. Keeping patients' records and running diagnostic scanners such as CT and MRI machines.

Q5. What is a reservation system?

Ans. A computer system used to book seats or tickets, for example for airlines, keeping an up-to-date record to avoid double-booking.

Q6. Give two uses of computers in education.

Ans. Computer-aided learning through interactive software and research on the Internet (also online exams and record keeping).

Long Questions & Answers

Q1: Explain the use of computers in business and e-commerce.

Computers have become essential tools in business because they handle large amounts of information quickly, accurately and cheaply. In everyday business operations, computers are used to keep the accounts and prepare the payroll that calculates each employee's pay; to store records of customers, suppliers and stock in databases that can be searched and updated in seconds; to produce invoices, receipts, letters and reports; and to communicate with customers and other offices by e-mail. Because the computer does routine calculations and record-keeping automatically, it reduces paperwork and human error, saves time and staff costs, and gives managers accurate, up-to-date information on which to base decisions. A more recent and rapidly growing business use of computers is e-commerce, which means carrying out trade, that is, buying and selling goods and services, over the Internet. In e-commerce a business sets up an online store or website where customers, wherever they are in the world, can browse the products, place their orders and pay electronically by card or online banking, after which the goods are delivered to them. E-commerce benefits the business by allowing it to reach a huge, worldwide market, to remain open twenty-four hours



a day, and to save the cost of renting and running physical shops; it benefits customers by giving them convenience, a wide choice and the ability to compare prices easily. Well-known examples include online shopping sites, online banking and online booking services.

Q2: Describe the use of computers in industry, including CAD and CAM, and in simulation.

Industry makes very heavy use of computers to design products, to control manufacturing and to improve quality and efficiency. In modern factories, computers control individual machines and entire production lines, monitor the quality of the goods being made, and keep track of raw materials and finished stock. Two especially important industrial applications are CAD and CAM. Computer-aided design (CAD) is the use of the computer to design and draw products, such as cars, aircraft, buildings and machine parts, accurately on the screen; the designer can create, change and test the design before anything is actually built, which saves both time and materials. Computer-aided manufacture (CAM) is the use of computers to control the machines and robots that actually produce the goods according to the design. When CAD and CAM are used together, a product can be designed on the computer and the design fed directly to the machines that make it, so that goods are produced quickly, accurately and at lower cost, with fewer errors. Closely related is the use of computers for simulation, in which the computer is used to imitate a real system or situation so that it can be studied without the cost or danger of the real thing. For example, trainee pilots learn to fly using flight simulators that behave like a real aircraft, engineers test the strength of a bridge or a car by simulating it before building it, and scientists model the weather or the spread of disease. Simulation allows people to experiment safely with situations that would otherwise be too dangerous, too expensive or impossible to try in reality, which is why it is widely used in training, research and design.

Q3: Describe the use of computers in medicine, airlines, education and the home.

Computers now play an important part in many areas of daily life. In medicine, they are used to keep detailed records of patients, to operate diagnostic machines such as CT and MRI scanners that produce clear images of the inside of the body, to monitor the condition of seriously ill patients continuously in intensive care, and to help control equipment during operations; in this way computers help doctors to diagnose illnesses more accurately, to store and share medical information instantly and to carry out medical research. In the airline and railway industries, computers run reservation systems that keep an up-to-date record of every flight or train and every seat, so that a travel agent anywhere can check availability and book a ticket at once without the risk of two people being given the same seat; computers also assist in controlling air traffic and in planning routes and schedules, making travel safer and more efficient. In education, computers are used for computer-aided learning, in which students study interactive lessons and tutorials at their own pace, for research using the Internet, for preparing assignments and presentations, for distance learning and online examinations, and for keeping student and examination records, all of which make learning more interesting and give access to a vast store of knowledge. In the home, computers and computer-controlled devices are used for entertainment such as



games, music and films, for communication through e-mail and social media, for online shopping and banking, and for study and work; even ordinary household appliances such as washing machines and microwave ovens contain small computers. Taken together, these applications show how computers simplify our work and daily lives by doing repetitive tasks quickly and accurately, storing and finding information easily, and connecting people through networks.

MCQs with Answers

1. Buying and selling over the Internet is called:

- (a) e-mail (b) e-commerce (c) e-book (d) e-learning

Correct Answer: (b) e-commerce. E-commerce.

2. Designing a product on a computer is:

- (a) CAM (b) CAD (c) CPU (d) CAI

Correct Answer: (b) CAD. CAD (computer-aided design).

3. Controlling machines that make a product is:

- (a) CAD (b) CAM (c) CD (d) CAL

Correct Answer: (b) CAM. CAM (computer-aided manufacture).

4. A flight simulator is an example of:

- (a) e-commerce (b) simulation (c) payroll (d) a database

Correct Answer: (b) simulation. Simulation.

5. CT and MRI scanners are computer uses in:

- (a) education (b) medicine (c) banking (d) industry

Correct Answer: (b) medicine. Medicine.

6. A system to book airline seats is a:

- (a) payroll (b) reservation system (c) simulator (d) spreadsheet

Correct Answer: (b) reservation system. Reservation system.

7. Learning through interactive software is:

- (a) CAD (b) CAM (c) computer-aided learning (d) e-commerce

Correct Answer: (c) computer-aided learning. Computer-aided learning.

8. Keeping employees' pay records is called:

- (a) payroll (b) payload (c) payment (d) packet

Correct Answer: (a) payroll. Payroll.

9. An organised collection of data on a computer is a:

- (a) network (b) database (c) protocol (d) modem

Correct Answer: (b) database. Database.

10. Household appliances like washing machines may contain a:

- (a) printer (b) small computer (c) modem (d) scanner

Correct Answer: (b) small computer. A small computer.



Quick Revision Summary

- Business: accounts, payroll, records, invoices, e-mail.
- E-commerce: online buying and selling; worldwide, 24/7, lower cost.
- Industry: CAD (design) + CAM (manufacture); simulation imitates real systems safely.
- Medicine: records, CT/MRI scanners, patient monitoring.
- Airline/education: reservation systems; computer-aided learning, online exams.
- Home: entertainment, communication, shopping; computers simplify repetitive work. Notes by freebooks.pk.

Exam Tips

- Clearly separate CAD (design) from CAM (manufacture).
- Define e-commerce and give an example.
- Explain simulation with the flight-simulator example.
- List two uses each for medicine, education and business.
- Mention reservation systems for airlines.
- Summarise how computers simplify work (speed, accuracy, storage, networking).

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CHAPTER 5

Computer Architecture

Key Concepts • Definitions • Short & Long Questions • MCQs • Diagrams • Exam Tips

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This chapter covers Computer Architecture from the 1st Year (ICS Part-I) Computer Science syllabus of the Punjab Curriculum and Textbook Board (PTB/PCTB). It explains bus interconnection, the I/O unit, CPU registers, computer operations and the instruction cycle, the instruction format, software and language translators. These notes are prepared by freebooks.pk.

Computer architecture describes how the internal parts of a computer are organised and how they work together to carry out instructions. This chapter looks inside the machine.

Learning Objectives

- Describe the system buses and their functions.
- Explain the role of the I/O unit and CPU registers.
- Describe the instruction (fetch-decode-execute) cycle.
- Explain the instruction format.
- State the purpose of system software.
- Describe the functions of language translators.

Key Concepts

Bus Interconnection

The parts of a computer, the CPU, memory and input/output units, are connected by groups of parallel wires called buses, along which data and signals travel. There are three main buses. The data bus carries the actual data between the CPU, memory and devices. The address bus carries the address of the memory location or device that the CPU wants to use, and works in one direction only. The control bus carries the control and timing signals that coordinate all the activities, such as read and write commands.

The Input/Output Unit

The input/output (I/O) unit connects the computer to the outside world, allowing input devices to send data into the computer and output devices to receive results from it. Because devices work at different speeds from the CPU, the I/O unit contains interfaces and buffers that hold data temporarily and match the speeds, so that the fast CPU is not held up waiting for slow devices.

CPU Registers

Registers are very small, very fast storage locations inside the CPU that hold data and instructions during processing. Important registers include the program counter (PC), which holds the address of the next instruction; the instruction register (IR), which holds the instruction currently being executed; the memory address register (MAR), which holds the address of the memory location to be accessed; the memory data register (MDR), which holds the data being transferred to or from memory; and the accumulator, which stores the results of arithmetic and logic operations.



Computer Operations and the Instruction Cycle

A computer runs a program by carrying out its instructions one after another in a repeating sequence called the instruction cycle or machine cycle, which has three steps. In the fetch step the next instruction is brought from memory into the CPU. In the decode step the control unit works out what the instruction means. In the execute step the instruction is carried out, for example by the ALU performing a calculation. The cycle then repeats for the next instruction until the program ends.

Instruction Format

Every machine instruction is made up of two parts. The operation code (opcode) tells the CPU what operation to perform, such as add, subtract, load or store. The operand (or address part) tells the CPU what data to use or where in memory to find it. Together the opcode and operand make up the instruction in a fixed pattern called the instruction format, which the control unit decodes.

Software and the Operating System

Software is the set of programs that make the hardware useful. The most important system software is the operating system, which starts the computer, manages the memory, files and devices, runs the user's programs and provides the interface between the user and the machine. Without an operating system the hardware could not be used conveniently.

Language Translators

Programs are usually written in a language that people can understand, but the computer can only run machine code (0s and 1s). Language translators are system programs that convert a program from one form to another. An assembler translates assembly language into machine code. A compiler translates a whole high-level language program into machine code at once, producing a file that can be run. An interpreter translates and runs a high-level program one statement at a time. These translators make programming in convenient languages possible.

Important Definitions

Term	Definition
Bus	A group of parallel wires that carries data or signals between parts of the computer.
Data bus	The bus that carries data between the CPU, memory and devices.
Address bus	The bus that carries the address of a memory location or device.
Control bus	The bus that carries control and timing signals.
Register	A small, fast storage location inside the CPU.
Instruction cycle	The repeating fetch-decode-execute sequence.



Term	Definition
Opcode	The part of an instruction that says which operation to perform.
Compiler	A translator that converts a whole high-level program into machine code.

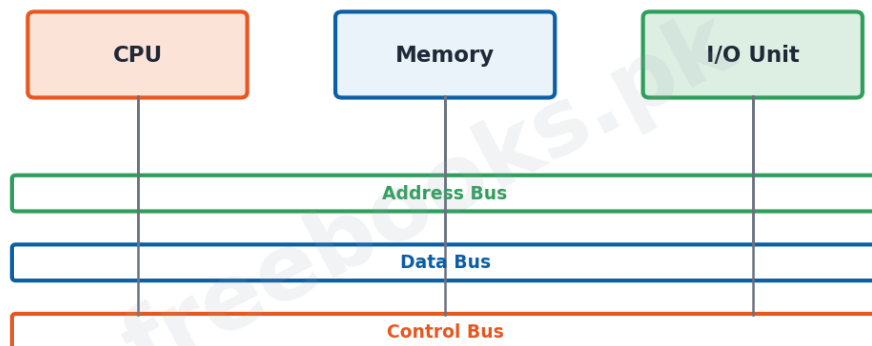
Key Facts & Rules

Item	Detail
Three buses	Data bus, Address bus, Control bus
Instruction cycle	Fetch -> Decode -> Execute
Instruction format	Opcode + Operand
Program counter (PC)	Holds the address of the next instruction
Accumulator	Holds results of arithmetic/logic operations
Compiler	Translates whole program at once
Interpreter	Translates and runs one statement at a time

Diagrams & Illustrations

System buses: the CPU, memory and I/O unit connected by the address bus, data bus and control bus.

System Buses (Address, Data, Control)

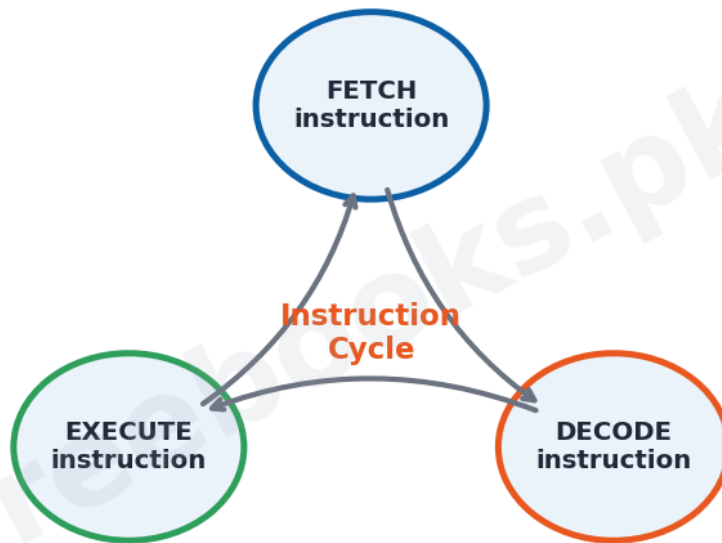


System buses

Fetch-decode-execute cycle: the instruction cycle repeating through the fetch, decode and execute steps.



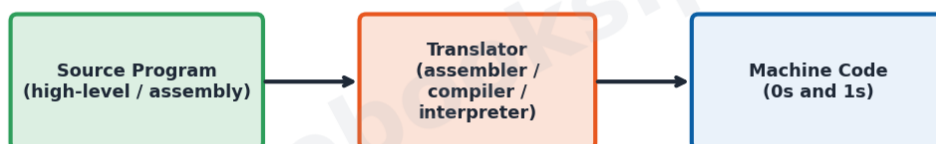
Fetch-Decode-Execute Cycle



Fetch-decode-execute cycle

Language translators: a source program passed through a translator (assembler, compiler or interpreter) to produce machine code.

Language Translators



Language translators

Solved Examples & Practice

Identify the bus

When the CPU sends the location of a memory cell it wants to read, it uses the address bus; the value read comes back on the data bus.



Order the cycle

The correct order of the instruction cycle is fetch, then decode, then execute.

Parts of an instruction

In the instruction ADD 20, 'ADD' is the opcode and '20' is the operand.

Choose the translator

To run a C program by first converting the whole program into an executable file, a compiler is used; to run it line by line, an interpreter is used.

Short Questions & Answers

Q1. Name the three system buses.

Ans. The data bus, the address bus and the control bus.

Q2. What is the function of the address bus?

Ans. It carries the address of the memory location or device that the CPU wants to access.

Q3. What is a register?

Ans. A small, very fast storage location inside the CPU used to hold data and instructions during processing.

Q4. State the three steps of the instruction cycle.

Ans. Fetch the instruction, decode it, then execute it.

Q5. What are the two parts of a machine instruction?

Ans. The opcode (the operation to perform) and the operand (the data or its address).

Q6. Differentiate a compiler and an interpreter.

Ans. A compiler translates the whole high-level program into machine code at once; an interpreter translates and runs it one statement at a time.

Long Questions & Answers

Q1: Describe the system buses and the CPU registers of a computer.

Inside a computer the main units, the central processing unit (CPU), the memory and the input/output units, are joined together by sets of parallel wires called buses, which carry data and control signals from one part to another. There are three principal buses. The data bus carries the actual data or instructions being transferred between the CPU, the memory and the input/output devices, and it works in both directions because data must be able to travel to and from the CPU. The address bus carries the address, that is, the number identifying the particular memory location or device that the CPU wishes to use; it works in one direction only, from the CPU outwards, and the more lines it has, the more memory the computer can address. The control bus carries the control and timing signals that coordinate all the operations of the computer, such as the signals that tell memory whether to perform a read or a write. In addition to the buses, the CPU itself contains a small number of very fast



storage locations called registers, which hold data and instructions while they are being processed. The program counter (PC) holds the address of the next instruction to be fetched; the instruction register (IR) holds the instruction currently being executed; the memory address register (MAR) holds the address of the memory location that is to be read from or written to; the memory data register (MDR) holds the data on its way to or from memory; and the accumulator stores the results produced by the arithmetic and logic unit. These registers, being inside the CPU, are far faster than main memory and are essential to the smooth running of the machine.

Q2: Explain the instruction (fetch-decode-execute) cycle and the instruction format.

A computer carries out a program by executing its machine instructions one after another, and the sequence of steps it repeats for every instruction is called the instruction cycle or machine cycle. The cycle has three basic stages. In the fetch stage, the control unit uses the address in the program counter to bring the next instruction from memory into the instruction register, and the program counter is then increased so that it points to the following instruction. In the decode stage, the control unit examines the instruction in the instruction register and works out what operation is required and what data it involves. In the execute stage, the operation is actually performed: this may involve the arithmetic and logic unit carrying out a calculation, or data being moved between registers and memory. After the execute stage the cycle begins again with the next instruction, and this continues until the program is finished. For the control unit to be able to decode an instruction, every machine instruction is arranged in a fixed pattern called the instruction format, which has two parts. The first part is the operation code, or opcode, which specifies the operation to be carried out, such as add, subtract, load or store. The second part is the operand, or address part, which specifies the data to be used or the memory address where that data is to be found. By reading the opcode the control unit knows what to do, and by reading the operand it knows what to do it to.

Q3: Explain the purpose of system software and describe the functions of language translators.

Hardware on its own can do nothing useful; it needs software, the set of programs that tell it what to do. The most important kind of software is system software, and in particular the operating system, which is the master control program of the computer. The operating system starts the computer when it is switched on, manages the main memory and decides where programs and data are placed, controls the input and output devices, organises files on the disk, loads and runs the user's application programs, and provides the interface through which the user gives commands to the machine. Without an operating system, an ordinary user could not conveniently use the hardware at all. Another essential group of system programs are the language translators, which are needed because programmers write their programs in languages that are convenient for people, such as high-level languages or assembly language, whereas the computer can only actually execute machine code made up of 0s and 1s. A translator converts a program from the form the programmer wrote into machine code. An assembler translates a program written in assembly language,



which uses short mnemonic codes, into machine code. A compiler translates an entire high-level language program into machine code in one operation, producing an executable file that can then be run as often as required and that runs quickly. An interpreter, by contrast, translates and immediately carries out a high-level program one statement at a time, which makes it convenient for testing but generally slower to run. Thanks to these translators, people can write programs in easy, meaningful languages while the computer still receives the machine code it needs.

MCQs with Answers

1. The bus that carries actual data is the:

- (a) address bus (b) data bus (c) control bus (d) local bus

Correct Answer: (b) data bus. The data bus.

2. The address bus works in:

- (a) both directions (b) one direction (c) no direction (d) reverse only

Correct Answer: (b) one direction. One direction (from the CPU).

3. Read and write signals travel on the:

- (a) data bus (b) address bus (c) control bus (d) system bus

Correct Answer: (c) control bus. The control bus.

4. A small fast store inside the CPU is a:

- (a) register (b) disk (c) cache tape (d) file

Correct Answer: (a) register. A register.

5. The register holding the next instruction's address is the:

- (a) IR (b) PC (c) MAR (d) MDR

Correct Answer: (b) PC. The program counter (PC).

6. The correct order of the instruction cycle is:

- (a) decode, fetch, execute (b) fetch, decode, execute (c) execute, fetch, decode (d) fetch, execute, decode

Correct Answer: (b) fetch, decode, execute. Fetch, decode, execute.

7. The part of an instruction giving the operation is the:

- (a) operand (b) opcode (c) address (d) register

Correct Answer: (b) opcode. The opcode.

8. The master control program of a computer is the:

- (a) compiler (b) operating system (c) assembler (d) browser

Correct Answer: (b) operating system. The operating system.

9. A translator that converts a whole program at once is a:

- (a) interpreter (b) compiler (c) loader (d) linker

Correct Answer: (b) compiler. A compiler.

10. An interpreter translates a program:

- (a) all at once (b) one statement at a time (c) never (d) into assembly

Correct Answer: (b) one statement at a time. One statement at a time.



Quick Revision Summary

- Buses: data (both ways), address (one way), control (signals).
- I/O unit connects devices; buffers match speeds.
- Registers: PC (next instruction), IR (current), MAR/MDR (memory), accumulator (results).
- Instruction cycle: fetch -> decode -> execute (repeats).
- Instruction format = opcode + operand.
- OS = master system software; translators: assembler, compiler (whole program), interpreter (one line). Notes by freebooks.pk.

Exam Tips

- Name the three buses and what each carries.
- List the main registers and their jobs.
- State the instruction cycle in the correct order.
- Split an instruction into opcode and operand.
- Give the main functions of the operating system.
- Compare compiler and interpreter clearly.

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CHAPTER 6

Security, Copyright and The Law

Key Concepts • Definitions • Short & Long Questions • MCQs • Diagrams • Exam Tips

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This chapter covers Security, Copyright and The Law from the 1st Year (ICS Part-I) Computer Science syllabus of the Punjab Curriculum and Textbook Board (PTB/PCTB). It explains computer viruses and antivirus software, data security threats and protection, privacy, data protection legislation and copyright. These notes are prepared by freebooks.pk.

As computers store more and more valuable information, protecting that data from viruses, theft and misuse becomes very important. This chapter explains the threats and how the law and good practice guard against them.

Learning Objectives

- Describe computer viruses, their types and how to guard against them.
- Explain data security and common security threats.
- Describe methods of data protection.
- Explain the importance of privacy.
- Describe data protection legislation.
- Explain copyright and software piracy.

Key Concepts

Computer Viruses

A computer virus is a small malicious program that attaches itself to other programs or files and spreads from one computer to another, often without the user's knowledge. Viruses can damage or delete data, slow the computer down, corrupt files or make the system unusable. They spread through infected files, e-mail attachments, downloads and removable media such as USB drives. Related harmful programs include worms, which spread by themselves over networks, and Trojan horses, which hide inside apparently useful software.

Antivirus and Safeguards

Antivirus software is a program that detects, prevents and removes viruses from a computer by scanning files and comparing them against known virus patterns. To safeguard a computer against viruses, users should install and regularly update antivirus software, avoid opening unknown e-mail attachments and downloads, scan removable media before use, and keep backup copies of important data so that it can be restored if it is damaged.

Data Security and Threats

Data security means protecting data from being lost, stolen, changed or accessed by people who are not authorised. The main security threats include viruses, hacking (gaining unauthorised access to a computer system), theft of data or equipment, accidental deletion, and hardware failure. A security violation is any action that breaks the rules protecting a system, such as an unauthorised person reading or changing confidential data.



Data Protection Methods

Several methods are used to protect data. Passwords and user identification restrict access so that only authorised people can use the system, and user access rights limit what each person may do. Antivirus software guards against viruses. Regular backups keep spare copies so that data can be restored after loss. Encryption scrambles data so that it cannot be understood if intercepted, and a firewall protects a network from outside attack. Physical security, such as locking computer rooms, protects the equipment itself.

Privacy

Privacy is the right of individuals to keep information about themselves confidential and to control how it is used. Computers make it easy to collect, store and share large amounts of personal data, so there is a risk that this data could be misused, sold or seen by people who have no right to it. Protecting privacy means ensuring that personal data is kept secure, is used only for the purpose for which it was collected, and is not passed on without permission.

Data Protection Legislation

Because of the risks to data and privacy, many countries have passed data protection laws (legislation). These laws set rules that organisations holding personal data must follow: the data must be obtained fairly and lawfully, kept accurate and up to date, used only for the stated purpose, kept secure, and not held for longer than necessary. People also have the right to see the data held about them. Such laws protect individuals from the misuse of their personal information.

Copyright and Software Piracy

Copyright is a legal right that gives the creator of an original work, such as software, a book, music or a film, control over how that work is copied and used. Software is protected by copyright, so copying, distributing or using software without permission or a proper licence is illegal and is called software piracy. Using pirated software is both against the law and harmful, because it denies the creators their reward and often comes with viruses. Users should always use genuine, licensed software.

Important Definitions

Term	Definition
Computer virus	A malicious program that spreads and damages data or programs.
Antivirus software	A program that detects, prevents and removes viruses.
Hacking	Gaining unauthorised access to a computer system.
Data security	Protecting data from loss, theft, change or unauthorised access.
Backup	A spare copy of data kept for recovery after loss.
Encryption	Scrambling data so that it cannot be understood if intercepted.



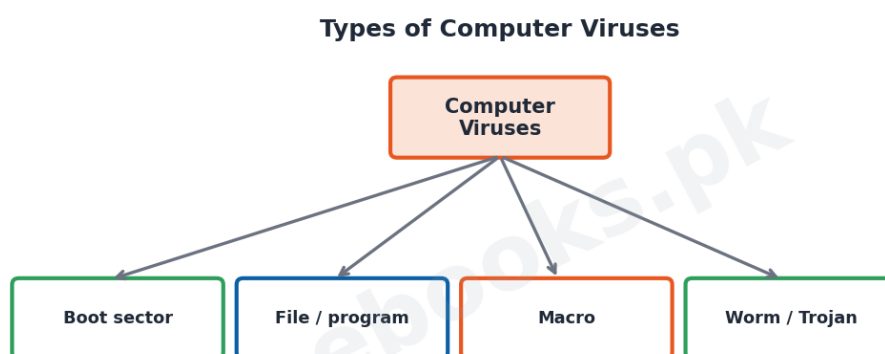
Term	Definition
Privacy	The right to keep personal information confidential.
Copyright	A legal right giving the creator control over the use of their work.

Key Facts & Rules

Item	Detail
Virus spreads by	Infected files, e-mail, downloads, USB drives
Guard against viruses	Antivirus + updates + backups + caution
Threats	Viruses, hacking, theft, deletion, failure
Protection methods	Passwords, access rights, backups, encryption, firewall
Software piracy	Illegal copying/using of copyrighted software
Copyright	Legal protection of original work

Diagrams & Illustrations

Types of viruses: the main types of computer viruses (boot sector, file/program, macro, worm/Trojan) spreading through files, e-mail and USB drives.



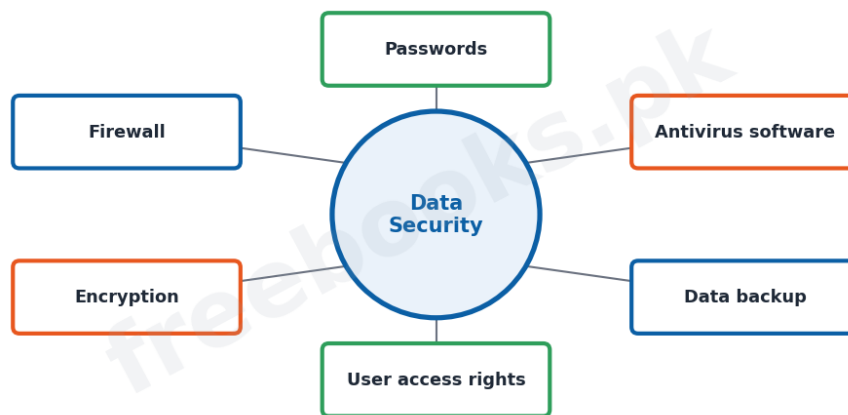
Spread by infected files, e-mail and USB drives

Types of viruses

Ways to protect data: the main methods of data protection around a central idea of data security: passwords, antivirus, backup, access rights, encryption and firewall.



Ways to Protect Data



Ways to protect data

Copyright and piracy: original work protected by copyright law, with illegal copying shown as piracy, an offence.

Copyright and Piracy



Copyright gives the creator legal rights over their work

Copyright and piracy

Solved Examples & Practice

Prevent a virus

To stop a USB drive spreading a virus, scan it with updated antivirus software before opening its files.

Identify the threat

An outsider guessing a password to read private files is committing hacking, a security violation.

Choose protection

To keep data safe if a hard disk fails, the best method is to keep regular backups.



Copyright

Copying a paid software program and selling copies without a licence is software piracy, which is illegal.

Short Questions & Answers

Q1. What is a computer virus?

Ans. A malicious program that attaches to files and spreads, damaging data or programs.

Q2. What is antivirus software?

Ans. A program that detects, prevents and removes viruses from a computer.

Q3. What is hacking?

Ans. Gaining unauthorised access to a computer system or its data.

Q4. Name three methods of data protection.

Ans. Passwords (and access rights), regular backups, and antivirus software (also encryption and firewalls).

Q5. What is privacy?

Ans. The right of individuals to keep information about themselves confidential and control its use.

Q6. What is software piracy?

Ans. The illegal copying, distribution or use of copyrighted software without permission or a licence.

Long Questions & Answers

Q1: Describe computer viruses and how a computer can be safeguarded against them.

A computer virus is a small program written deliberately to cause harm; it attaches itself to other programs or files and copies itself from one file or computer to another, usually without the user being aware of it. Once active, a virus may damage or delete data, corrupt files, slow the computer down, display unwanted messages or even make the whole system unusable. Viruses spread in several ways: through infected program files, through e-mail attachments, through files downloaded from the Internet, and through removable media such as USB flash drives and memory cards. Related kinds of malicious software include worms, which can spread by themselves across a network without needing to attach to a file, and Trojan horses, which disguise themselves as useful programs but carry out harmful actions once run. To protect a computer against viruses, several precautions should be taken together. The most important is to install antivirus software, a program that scans files, detects known viruses by their patterns and removes them, and to keep this software regularly updated so that it can recognise new viruses. In addition, users should not open e-mail attachments or download files from unknown or untrusted sources, should scan any removable media before using it, should avoid using pirated software, and should keep



regular backup copies of important data so that, even if a virus does strike, the data can be restored. Following these practices greatly reduces the risk of infection and data loss.

Q2: Explain data security, the common threats to data, and the methods used to protect it.

Data security means keeping data safe from being lost, stolen, altered or seen by people who are not authorised to use it; it is important because the information stored on computers, such as financial records, personal details and business data, is often valuable and confidential. Data faces several kinds of threat. Viruses and other malicious programs can destroy or corrupt data. Hacking is the act of gaining unauthorised access to a computer system, often to read, steal or change data. Data or equipment may simply be stolen. Data can also be lost through accidental deletion by users or through hardware failures such as a crashed hard disk. Any action that breaks the rules protecting the system, such as an unauthorised person reading confidential files, is called a security violation. To guard against these threats a combination of methods is used. Passwords and user identification make sure that only authorised people can log in, while user access rights control what each person is allowed to do, so that ordinary users cannot change important data. Antivirus software protects against viruses. Regular backups keep spare copies of data in a safe place so that it can be recovered if the original is lost or damaged. Encryption scrambles data into a coded form so that even if it is intercepted it cannot be understood without the key, and a firewall protects a network by blocking unauthorised access from outside. Finally, physical security measures such as locking computer rooms and fixing down equipment protect the hardware itself. Used together, these methods keep data safe and available.

Q3: Explain privacy, data protection legislation and copyright, including software piracy.

As computers make it easy to gather and store large amounts of personal information, three related issues become important: privacy, data protection and copyright. Privacy is the right of individuals to keep information about themselves confidential and to have a say in how that information is used; the danger is that personal data collected by shops, banks, hospitals and websites could be misused, sold or seen by people with no right to it. To protect privacy, many countries have passed data protection legislation, that is, laws that lay down rules which any organisation holding personal data must obey. Typically these rules require that personal data be obtained fairly and lawfully, be kept accurate and up to date, be used only for the purpose for which it was collected, be kept secure against loss or theft, and not be kept for longer than necessary; the laws also usually give individuals the right to see the data held about them and to have mistakes corrected. Separately, copyright is a legal right that protects the creators of original works, including computer software, books, music and films, by giving them control over how their work is copied, distributed and used. Because software is protected by copyright, copying, sharing or using it without the proper permission or licence is illegal and is known as software piracy. Software piracy is not only against the law but is also harmful: it denies software developers the reward for their work, and illegal copies often carry viruses or lack proper support. For all these reasons, users



should respect privacy, follow data protection rules, and always use genuine, licensed software.

MCQs with Answers

1. A malicious program that spreads and damages data is a:

(a) compiler (b) virus (c) register (d) browser

Correct Answer: (b) virus. A virus.

2. Software that removes viruses is called:

(a) antivirus (b) firmware (c) freeware (d) malware

Correct Answer: (a) antivirus. Antivirus software.

3. Gaining unauthorised access to a system is:

(a) backup (b) hacking (c) encryption (d) piracy

Correct Answer: (b) hacking. Hacking.

4. A spare copy of data for recovery is a:

(a) backup (b) virus (c) cache (d) cookie

Correct Answer: (a) backup. A backup.

5. Scrambling data so it cannot be understood is:

(a) backup (b) encryption (c) hacking (d) printing

Correct Answer: (b) encryption. Encryption.

6. A device that blocks unauthorised network access is a:

(a) firewall (b) modem (c) printer (d) scanner

Correct Answer: (a) firewall. A firewall.

7. The right to keep personal data confidential is:

(a) copyright (b) privacy (c) piracy (d) backup

Correct Answer: (b) privacy. Privacy.

8. Illegal copying of software is called:

(a) backup (b) piracy (c) encryption (d) hacking

Correct Answer: (b) piracy. Software piracy.

9. A worm spreads:

(a) only by e-mail (b) by itself over a network (c) only via USB (d) never

Correct Answer: (b) by itself over a network. By itself over a network.

10. Copyright protects:

(a) only hardware (b) original works like software (c) only websites (d) nothing

Correct Answer: (b) original works like software. Original works such as software.

Quick Revision Summary

- Virus = malicious program that spreads (via files, e-mail, USB); worms/Trojans related.
- Antivirus (kept updated) + backups + caution safeguard against viruses.



- Threats: viruses, hacking, theft, deletion, hardware failure.
- Protection: passwords, access rights, backups, encryption, firewall, physical security.
- Privacy = right to keep personal data confidential; data protection laws set the rules.
- Copyright protects original works; illegal copying of software = piracy (offence).
Notes by freebooks.pk.

Exam Tips

- Define a virus and list ways it spreads.
- State how to guard against viruses (antivirus + updates + backups).
- List the main threats to data.
- Give at least four data-protection methods.
- Explain privacy and what data protection laws require.
- Define copyright and software piracy.

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CHAPTER 7

Windows Operating System

Key Concepts • Definitions • Short & Long Questions • MCQs • Diagrams • Exam Tips

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This chapter covers the Windows Operating System from the 1st Year (ICS Part-I) Computer Science syllabus of the Punjab Curriculum and Textbook Board (PTB/PCTB). It explains the types and purpose of operating systems, the difference between GUI and command-line systems, the objects of the Windows desktop and the management of files and folders. These notes are prepared by freebooks.pk.

The operating system is the most important software on a computer. Windows is a popular graphical operating system, and this chapter explains how it lets us control the computer and organise our work.

Learning Objectives

- State the purpose of an operating system.
- Distinguish GUI and command-line operating systems.
- Identify the main objects of the Windows desktop.
- Describe basic window operations.
- Explain files and folders and how they are organised.
- Describe simple file management tasks.

Key Concepts

Purpose of an Operating System

An operating system (OS) is the system software that controls and manages all the operations of a computer and acts as a bridge between the user and the hardware. Its main purposes are to start the computer, manage the memory, control the input and output devices, organise files and folders on the disk, load and run application programs, and provide a convenient way for the user to give commands. Without an operating system the computer cannot be used.

Types of Operating System: GUI and CLI

Operating systems provide two main kinds of user interface. A graphical user interface (GUI) operating system, such as Windows, lets the user work with pictures called icons, windows, menus and buttons using a mouse, which is easy to learn and use. A command-line interface (CLI) operating system, such as DOS, requires the user to type commands in words; it is powerful and uses fewer resources but is harder to learn because the user must remember the commands. Windows is a GUI operating system.

Objects of the Windows Desktop

When Windows starts, it displays the desktop, the main working screen. The desktop contains several objects. Icons are small pictures that represent programs, files or folders, and can be opened with a click. The taskbar is the bar (usually at the bottom) that shows the running programs and the clock. The Start button (or Start menu) opens a menu from which



programs and settings can be launched. A window is the rectangular area in which a program or folder is displayed, with a title bar at the top.

Window Operations

Because several programs can run at once, each in its own window, Windows lets the user control these windows. A window can be minimised (reduced to a button on the taskbar), maximised (enlarged to fill the screen) or restored to its previous size, and it can be moved by dragging its title bar or resized by dragging its border. A window is closed with the close button. These operations let the user switch easily between different tasks.

Files and Folders

All the information on a computer is stored as files. A file is a collection of related data or a program stored under a name, such as a document or a picture. To keep files organised, they are grouped into folders (also called directories), and folders may contain other folders, forming a tree-like structure on a storage drive such as C:. Each file has a name and usually an extension (like .doc or .mp3) that shows its type.

File Management

Windows provides tools, such as File Explorer, for managing files and folders. Common file-management tasks include creating a new folder, copying or moving a file from one place to another, renaming a file, deleting a file (which sends it to the Recycle Bin), and searching for a file. Good file management, using clearly named folders, keeps work organised and makes files easy to find.

Working in Windows

To use Windows the user starts the computer, which loads Windows and shows the desktop; programs are then opened from the Start menu or by clicking an icon. The mouse is used to point, click, double-click and drag, and the keyboard to type. When work is finished, files are saved and the computer is shut down properly through the Start menu so that no data is lost. These simple skills allow a student to operate the computer confidently.

Important Definitions

Term	Definition
Operating system	System software that controls the computer and links the user to the hardware.
GUI	A graphical user interface using icons, windows and a mouse (e.g. Windows).
CLI	A command-line interface in which the user types commands (e.g. DOS).
Desktop	The main working screen shown when Windows starts.
Icon	A small picture representing a program, file or folder.
Taskbar	The bar showing running programs and the clock.
File	A named collection of related data or a program.



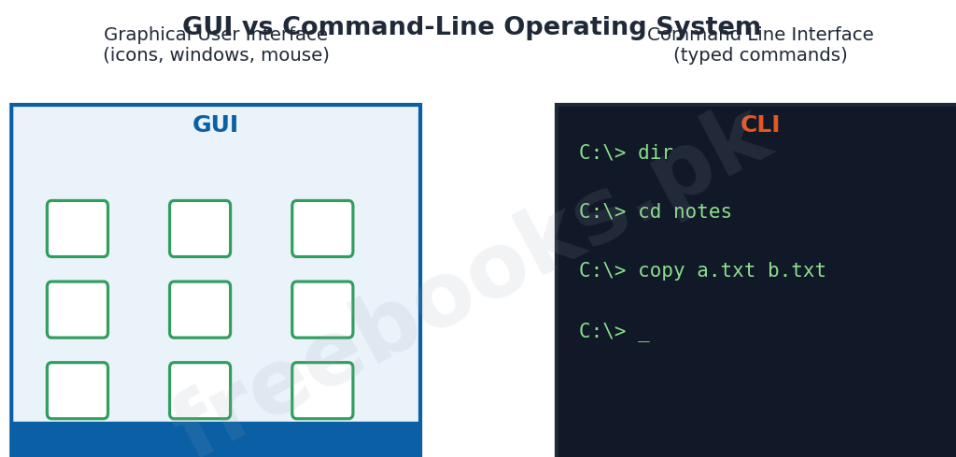
Term	Definition
Folder	A container used to organise files (also called a directory).

Key Facts & Rules

Item	Detail
OS purpose	Manages hardware, memory, files; runs programs; user interface
GUI	Icons, windows, menus, mouse (Windows)
CLI	Typed commands (DOS)
Desktop objects	Icons, taskbar, Start menu, windows
Window ops	Minimise, maximise, restore, move, resize, close
File extension	Shows the file type (.doc, .mp3, .exe)

Diagrams & Illustrations

GUI vs command-line: a graphical user interface with icons and windows compared with a command-line interface where the user types commands.

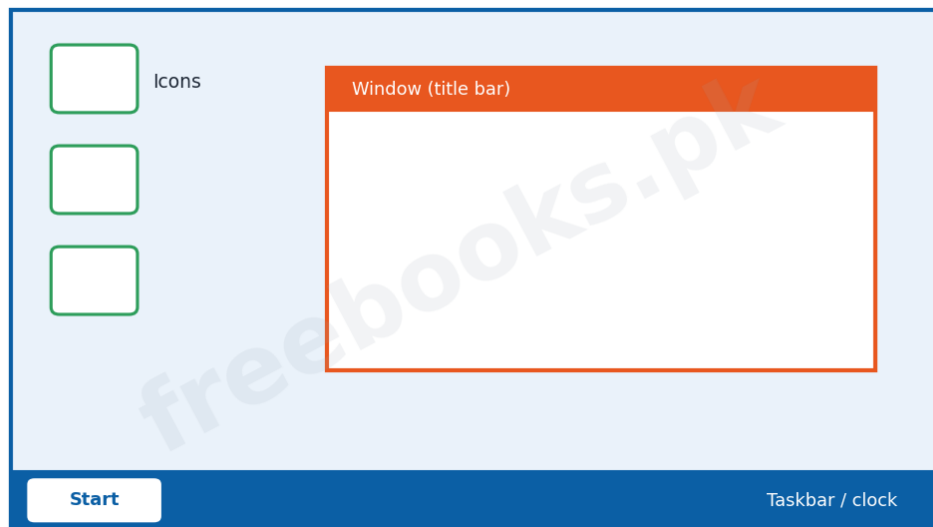


GUI vs command-line

Windows desktop elements: the Windows desktop showing icons, a window with a title bar, the taskbar and the Start button.



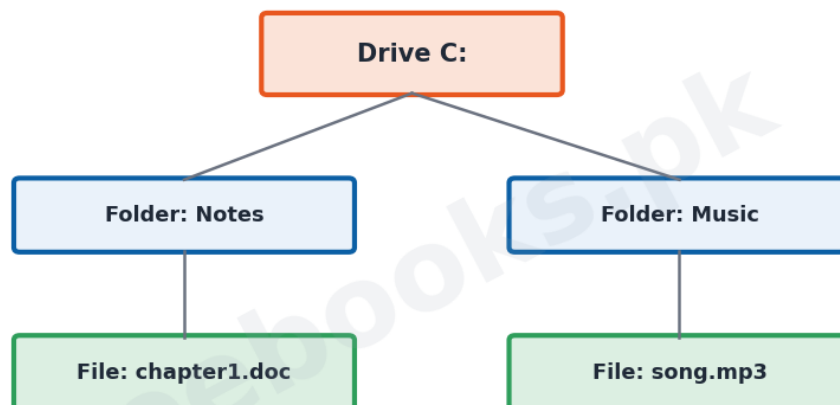
Windows Desktop Elements



Windows desktop elements

Files and folders: a drive containing folders, which in turn contain files, forming a tree-like storage hierarchy.

Files and Folders (Storage Hierarchy)



Files are stored inside folders on a drive

Files and folders

Solved Examples & Practice

Identify the interface

Working with icons and a mouse in Windows is using a GUI; typing 'dir' to list files is using a CLI.



Window operation

Clicking the middle button on the title bar to make a window fill the whole screen is maximising it.

File extension

In the file 'report.doc', 'report' is the name and '.doc' is the extension showing it is a document.

File management

Moving a file into a new clearly named folder is a file-management task that keeps work organised.

Short Questions & Answers

Q1. What is an operating system?

Ans. System software that controls and manages the computer and provides the interface between the user and the hardware.

Q2. Differentiate GUI and CLI operating systems.

Ans. A GUI uses icons, windows and a mouse and is easy to use; a CLI requires the user to type commands and is harder to learn.

Q3. What is the desktop?

Ans. The main working screen displayed when Windows starts, containing icons, the taskbar and the Start button.

Q4. What is an icon?

Ans. A small picture that represents a program, file or folder and can be opened with a click.

Q5. Differentiate a file and a folder.

Ans. A file is a named collection of data or a program; a folder is a container used to organise files.

Q6. Name three window operations.

Ans. Minimise, maximise and close (also restore, move and resize).

Long Questions & Answers

Q1: State the purpose of an operating system and distinguish between GUI and command-line operating systems.

An operating system is the most important piece of system software on a computer, because it controls and manages everything the machine does and provides the link between the user and the hardware. Its purposes are many. It starts the computer up when it is switched on and prepares it for use. It manages the main memory, deciding where programs and data are placed. It controls the input and output devices such as the keyboard, mouse, screen and



printer, so that programs can use them. It organises the storage of information into files and folders on the disks and keeps track of where everything is. It loads and runs the user's application programs and shares the processor's time between them. Above all, it provides a convenient interface through which the user can give instructions to the computer.

Operating systems offer this interface in one of two main styles. A graphical user interface (GUI) operating system, of which Windows is the best-known example, lets the user work with small pictures called icons, together with windows, menus and buttons, all controlled by a mouse; because the user can simply point and click, a GUI is easy to learn and pleasant to use, though it needs more memory and processing power. A command-line interface (CLI) operating system, such as the older DOS, has no pictures: the user must type commands in words, for example 'dir' to list files or 'copy' to copy them. A CLI is fast and uses few resources, and it gives an expert precise control, but it is harder for beginners because they must remember the exact commands. Windows is a GUI operating system, which is why it became so popular with ordinary users.

Q2: Describe the main objects of the Windows desktop and the basic window operations.

When Windows finishes loading, it displays the desktop, which is the main working area on the screen and the starting point for all the user's work. Several important objects appear on the desktop. Icons are small pictures, each representing a program, a file or a folder; clicking or double-clicking an icon opens the item it stands for. The taskbar is the strip that usually runs along the bottom of the screen; it shows buttons for the programs that are currently running and normally displays the clock and other indicators, and it lets the user switch quickly from one open program to another. At one end of the taskbar is the Start button, which opens the Start menu, a list from which the user can launch programs, open documents, change settings and shut down the computer. When a program or folder is opened it appears in a window, a rectangular area with a title bar across the top showing its name. Because Windows can run several programs at once, each in its own window, it provides operations for managing them. A window can be minimised, which hides it away as a button on the taskbar without closing it; maximised, which enlarges it to fill the whole screen; or restored to its earlier size. A window can be moved to another position by dragging its title bar, resized by dragging its border, and finally closed with the close button when it is no longer needed. These operations let the user arrange the screen and move smoothly between different tasks.

Q3: Explain files and folders and describe basic file-management tasks in Windows.

All the information kept on a computer, whether it is a document, a picture, a song or a program, is stored as a file, which is simply a collection of related data saved under a name. To stop the thousands of files on a computer from becoming a confused jumble, they are organised into folders, also called directories, each of which is a container that can hold files and even other folders; in this way the storage on a drive such as the C: drive is arranged as a tree-like structure of folders within folders. Every file has a name, and usually an extension separated by a dot, such as .doc, .mp3 or .exe, which indicates the type of the file and the



program that opens it. Windows provides a tool, File Explorer, for looking after files and folders, and the user can carry out a number of common file-management tasks. A new folder can be created and given a meaningful name to hold related files. A file can be copied, which makes a second copy in another place while leaving the original, or moved, which transfers it to a new place. A file can be renamed to give it a clearer name. A file that is no longer wanted can be deleted, which normally sends it to the Recycle Bin from where it can be recovered if deleted by mistake. Files can also be searched for by name when their location is forgotten. By using clearly named folders and keeping related files together, the user practises good file management, which keeps work tidy and makes any file quick and easy to find.

MCQs with Answers

1. The most important system software is the:

(a) browser (b) operating system (c) compiler (d) spreadsheet

Correct Answer: (b) operating system. The operating system.

2. Windows is an example of a ___ operating system:

(a) command-line (b) GUI (c) assembly (d) network only

Correct Answer: (b) GUI. GUI.

3. Typing commands in words is a feature of a:

(a) GUI (b) CLI (c) icon (d) window

Correct Answer: (b) CLI. CLI (command-line interface).

4. The main working screen in Windows is the:

(a) taskbar (b) desktop (c) folder (d) file

Correct Answer: (b) desktop. The desktop.

5. A small picture representing a program is an:

(a) icon (b) index (c) image only (d) opcode

Correct Answer: (a) icon. An icon.

6. Making a window fill the whole screen is:

(a) minimising (b) maximising (c) closing (d) moving

Correct Answer: (b) maximising. Maximising.

7. A named collection of related data is a:

(a) folder (b) file (c) drive (d) window

Correct Answer: (b) file. A file.

8. A container that organises files is a:

(a) file (b) folder (c) icon (d) taskbar

Correct Answer: (b) folder. A folder.

9. A deleted file usually goes to the:

(a) taskbar (b) Recycle Bin (c) Start menu (d) desktop

Correct Answer: (b) Recycle Bin. The Recycle Bin.

10. '.doc' at the end of a file name is the:



(a) folder (b) extension (c) icon (d) path

Correct Answer: (b) extension. Extension (file type).

Quick Revision Summary

- OS = master software; manages hardware, memory, files, runs programs, gives interface.
 - GUI (Windows): icons/windows/mouse, easy. CLI (DOS): typed commands, harder.
 - Desktop objects: icons, taskbar, Start button/menu, windows (title bar).
 - Window ops: minimise, maximise, restore, move, resize, close.
 - File = named data/program; folder organises files; extension shows type.
 - File management: create folder, copy, move, rename, delete (Recycle Bin), search.
- Notes by freebooks.pk.

Exam Tips

- List the main purposes of the operating system.
- Compare GUI and CLI with examples (Windows vs DOS).
- Name the desktop objects (icons, taskbar, Start, window).
- Know the window operations (minimise/maximise/close).
- Differentiate a file from a folder; explain extensions.
- List common file-management tasks.

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1st Year Computer Science — Punjab Board

CHAPTER 8

Word Processing

Key Concepts • Definitions • Short & Long Questions • MCQs • Diagrams • Exam Tips

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This chapter covers Word Processing from the 1st Year (ICS Part-I) Computer Science syllabus of the Punjab Curriculum and Textbook Board (PTB/PCTB). It explains what a word processor is, how to create, edit, format, save and print documents, and useful features such as find and replace, spell check, tables and mail merge. These notes are prepared by freebooks.pk.

A word processor is one of the most widely used application programs. This chapter explains how it is used to produce neat, professional documents such as letters, reports and assignments.

Learning Objectives

- Define word processing and a word processor.
- Describe how to create, save, open and print a document.
- Explain editing features such as cut, copy, paste and find/replace.
- Explain text formatting.
- Describe useful features like spell check, tables and mail merge.
- State the advantages of a word processor over a typewriter.

Key Concepts

Word Processing and the Word Processor

Word processing is the use of a computer to create, edit, format, store and print documents made of text. A word processor is the application software used for this purpose; common examples are Microsoft Word and similar programs. With a word processor a user can type documents such as letters, reports, assignments and books, change them easily, make them look attractive, and save them for later use or printing.

Creating, Saving and Printing a Document

To make a document the user opens the word processor, which shows a blank page, and types the text using the keyboard. The document is then saved with a name on a disk so that it is not lost and can be opened and changed again later. A saved document can be reopened at any time, and when it is ready it can be printed on paper to produce a hard copy. Saving regularly is important so that work is not lost if the computer fails.

Editing a Document

Editing means changing the contents of a document. A word processor makes editing easy. Text can be inserted or deleted anywhere, and a block of text can be selected and then cut (removed) or copied and pasted somewhere else, using the clipboard. The find (search) feature locates a word in the document, and find and replace changes every occurrence of one word with another automatically. These features save a great deal of time compared with retyping.



Formatting Text

Formatting means changing the appearance of a document to make it clear and attractive. The user can change the font (style) and size of the text, make text bold, italic or underlined, change its colour, and set the alignment of paragraphs to the left, right, centre or justified. Line spacing, margins, bullets and numbering can also be set. Good formatting makes a document easy to read and gives it a professional look.

Useful Features

Word processors provide many helpful features. The spelling and grammar checker finds and corrects mistakes. Tables let information be arranged neatly in rows and columns. Headers and footers put the same text (such as a page number or title) at the top or bottom of every page. Pictures and shapes can be inserted, and mail merge can produce many personalised letters (for example, the same letter addressed to different people) automatically from a list.

Mail Merge

Mail merge is a special feature used to create a large number of similar documents, such as letters or certificates, each personalised with different details. It combines a main document, which contains the fixed text, with a data source, which contains the variable information such as names and addresses. The word processor then produces one copy of the document for each record in the list, saving the user from typing each letter separately.

Advantages of a Word Processor

A word processor has many advantages over an old-fashioned typewriter. Mistakes can be corrected easily before printing, so no correction fluid is needed. Documents can be saved and reused, and the same document can be printed many times. The appearance can be improved with formatting, spelling can be checked automatically, and copies can be shared electronically. These advantages make the word processor an essential tool in offices, schools and homes.

Important Definitions

Term	Definition
Word processing	Using a computer to create, edit, format, store and print text documents.
Word processor	The application software used for word processing (e.g. MS Word).
Editing	Changing the contents of a document.
Formatting	Changing the appearance of a document.
Clipboard	A temporary store that holds cut or copied text for pasting.
Find and replace	A feature that finds a word and replaces it with another.
Header and footer	Text repeated at the top or bottom of every page.



Term	Definition
Mail merge	Producing many personalised documents from a main document and a data list.

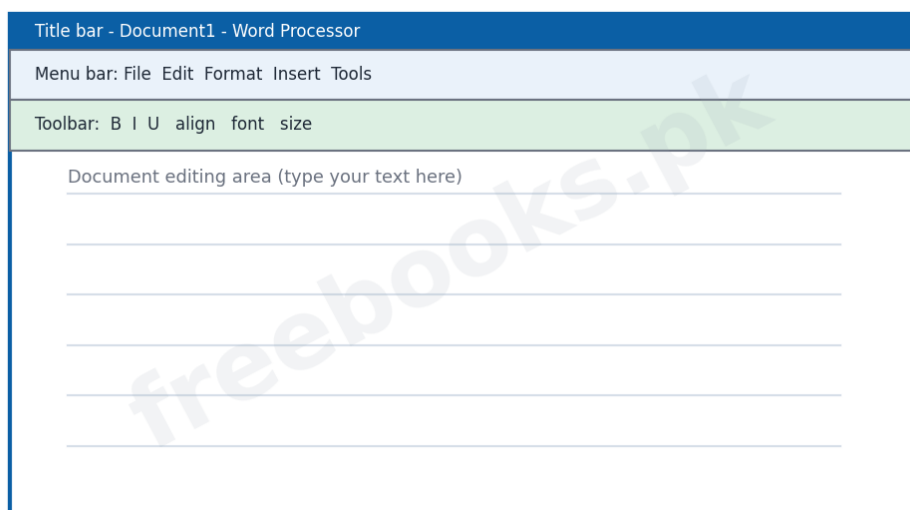
Key Facts & Rules

Item	Detail
Word processor	Software to create/edit/format/print documents
Editing tools	Insert, delete, cut, copy, paste, find and replace
Formatting	Font, size, bold/italic/underline, colour, alignment
Save	Store a document with a name for later use
Spell check	Finds and corrects spelling mistakes
Mail merge	Main document + data source -> many letters

Diagrams & Illustrations

Word processor window: a word processor window with a title bar, menu bar, toolbar and the document editing area where text is typed.

A Word Processor Window

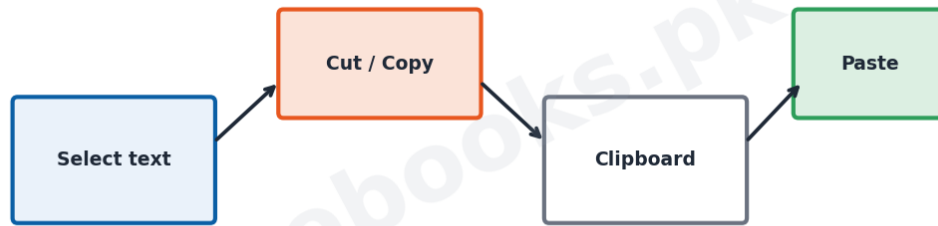


Word processor window

Cut, copy and paste: selecting text, cutting or copying it to the clipboard and pasting it elsewhere.



Editing: Cut, Copy and Paste



Cut/Copy -> Clipboard -> Paste elsewhere

Cut, copy and paste

Text formatting: examples of formatting: bold, italic, underline, a large heading and left, centre and right alignment.

Text Formatting

Normal text

Bold text

Italic text

Underline text

Large heading

Alignment:

Left

Center

Right

Text formatting

Solved Examples & Practice

Editing task

To move a paragraph to a new place without retyping it, select it, cut it, then paste it in the new location.

Formatting task

To make a heading stand out, select it and make it bold and larger, then centre it.

Find and replace

To change the word 'colour' to 'color' everywhere in a document, use find and replace.



Mail merge

To send the same invitation to fifty people with their names filled in, use mail merge with a list of names.

Short Questions & Answers

Q1. What is a word processor?

Ans. Application software used to create, edit, format, save and print text documents, such as MS Word.

Q2. Differentiate editing and formatting.

Ans. Editing changes the contents of a document (adding, deleting, moving text); formatting changes its appearance (font, style, alignment).

Q3. What is the clipboard?

Ans. A temporary storage area that holds text that has been cut or copied, ready to be pasted.

Q4. What is find and replace?

Ans. A feature that finds a word in a document and replaces every occurrence of it with another word.

Q5. What is a header and footer?

Ans. Text, such as a page number or title, that is repeated at the top (header) or bottom (footer) of every page.

Q6. What is mail merge?

Ans. A feature that produces many personalised documents by combining a main document with a list of data.

Long Questions & Answers

Q1: Define word processing and describe how a document is created, edited and formatted.

Word processing is the use of a computer to create, edit, format, store and print documents that are made up of text, and the application software used to do it is called a word processor; common examples include Microsoft Word. Working with a word processor involves three main activities. The first is creating the document: the user opens the word processor, which presents a blank page, types the text using the keyboard, and then saves the document under a name on a disk so that it will not be lost and can be opened again later; when it is complete it can be printed to give a hard copy on paper. The second activity is editing, which means changing the contents of the document. Because the text is held in the computer, it is very easy to insert new text, delete unwanted text, or select a block of text and move it by cutting it and pasting it elsewhere, or copy it to repeat it; the find feature can locate a particular word, and find and replace can change every occurrence of a word automatically. The third activity is formatting, which means changing the appearance



of the document to make it clear and attractive. The user can choose the font and size of the text, make words bold, italic or underlined, change their colour, and align paragraphs to the left, right, centre or justified, as well as adjust line spacing, margins and add bullets or numbering. Together, these abilities to create, edit and format make it easy to produce neat, professional documents quickly.

Q2: Describe the useful features of a word processor, including spell check, tables and mail merge.

Beyond the basic typing and formatting of text, a word processor offers many features that make producing documents faster and easier. One of the most useful is the spelling and grammar checker, which automatically finds spelling and grammar mistakes and suggests corrections, so that documents can be made accurate without careful manual proofreading. Tables allow information to be arranged neatly in rows and columns, which is ideal for lists, timetables and results. Headers and footers place the same information, such as a title, the date or an automatic page number, at the top or bottom of every page. Pictures, shapes, charts and symbols can be inserted into the text to illustrate the document. A particularly powerful feature is mail merge, which is used to produce a large number of similar documents that differ only in certain details, such as letters or certificates each addressed to a different person. Mail merge works by combining a main document, which contains the text that is the same on every copy, with a data source, which is a list containing the variable information such as names and addresses; the word processor then automatically produces one personalised copy for each record in the list. This saves an enormous amount of time compared with typing each letter separately. Features such as these are what make the word processor so much more than an electronic typewriter.

Q3: Explain the advantages of using a word processor over a typewriter.

The word processor has almost completely replaced the typewriter because it offers many important advantages. The greatest advantage is the ease of correcting and changing text: with a typewriter a mistake meant retyping the page or using correction fluid, but with a word processor any mistake can be corrected on the screen before the document is printed, and text can be inserted, deleted or moved freely. A word processor can save a document on a disk, so that the same document can be opened, edited and printed again and again, and many identical copies can be printed from one file, whereas a typist would have to retype the whole document each time. The appearance of the work can be greatly improved by formatting, choosing different fonts and sizes, using bold and italic, aligning and spacing the text and adding tables and pictures, none of which is possible on an ordinary typewriter. The built-in spelling and grammar checker helps to remove errors automatically, and features such as find and replace and mail merge save time on repetitive work. Finally, documents produced on a word processor can be stored compactly, shared electronically by e-mail and reused as templates. For all these reasons the word processor is faster, more flexible and produces far better-looking results than a typewriter, and it has become an essential tool in offices, schools and homes.



MCQs with Answers

1. Software used to create and edit text documents is a:

(a) spreadsheet (b) word processor (c) browser (d) compiler

Correct Answer: (b) word processor. A word processor.

2. Changing the contents of a document is:

(a) formatting (b) editing (c) saving (d) printing

Correct Answer: (b) editing. Editing.

3. Changing the appearance of a document is:

(a) editing (b) formatting (c) copying (d) deleting

Correct Answer: (b) formatting. Formatting.

4. Cut or copied text is held on the:

(a) desktop (b) clipboard (c) taskbar (d) printer

Correct Answer: (b) clipboard. The clipboard.

5. Making text darker and thicker is applying:

(a) italic (b) bold (c) underline (d) colour

Correct Answer: (b) bold. Bold.

6. Text repeated at the bottom of every page is a:

(a) header (b) footer (c) margin (d) title

Correct Answer: (b) footer. A footer.

7. Changing every 'colour' to 'color' at once uses:

(a) spell check (b) find and replace (c) mail merge (d) print

Correct Answer: (b) find and replace. Find and replace.

8. Producing many personalised letters uses:

(a) mail merge (b) clipboard (c) header (d) font

Correct Answer: (a) mail merge. Mail merge.

9. Arranging data in rows and columns uses a:

(a) table (b) header (c) font (d) margin

Correct Answer: (a) table. A table.

10. An advantage of a word processor over a typewriter is:

(a) cannot save (b) easy correction (c) no printing (d) slower

Correct Answer: (b) easy correction. Easy correction of mistakes.

Quick Revision Summary

- Word processor = software to create/edit/format/save/print documents (e.g. MS Word).
- Create -> save (with a name) -> open again -> print (hard copy).
- Editing: insert, delete, cut/copy/paste (clipboard), find and replace.
- Formatting: font, size, bold/italic/underline, colour, alignment, spacing.
- Features: spell check, tables, headers/footers, images, mail merge.



- Advantages over typewriter: easy correction, save/reuse, formatting, spell check.
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Exam Tips

- Define word processing and name a word processor.
- Clearly separate editing from formatting.
- Explain cut/copy/paste using the clipboard.
- List formatting options (font, bold, alignment).
- Describe mail merge (main document + data list).
- Give advantages of a word processor over a typewriter.

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CHAPTER 9

Spreadsheet Software

Key Concepts • Definitions • Short & Long Questions • MCQs • Diagrams • Exam Tips

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This chapter covers Spreadsheet Software from the 1st Year (ICS Part-I) Computer Science syllabus of the Punjab Curriculum and Textbook Board (PTB/PCTB). It explains what a spreadsheet is, cells, rows and columns, the types of data, formulas and functions, formatting, charts and the uses of spreadsheets. These notes are prepared by freebooks.pk.

A spreadsheet is a powerful tool for working with numbers. This chapter explains how it organises data in a grid and performs calculations automatically, which is why it is used in business, science and daily life.

Learning Objectives

- Define a spreadsheet and a worksheet.
- Describe cells, rows, columns and cell references.
- Identify the types of data entered in a cell.
- Use formulas and functions to perform calculations.
- Describe formatting and charts in a spreadsheet.
- State the uses of spreadsheet software.

Key Concepts

Spreadsheet and Worksheet

A spreadsheet is application software used to organise data, mainly numbers, in the form of a grid and to perform calculations on it automatically. Popular spreadsheet programs include Microsoft Excel. The working area is called a worksheet, which is a large grid of rows and columns; a file may contain several worksheets, and the whole file is called a workbook.

Cells, Rows and Columns

A worksheet is divided into columns, which run down the screen and are labelled with letters (A, B, C ...), and rows, which run across the screen and are labelled with numbers (1, 2, 3 ...). The box where a column and a row meet is called a cell, and it is the basic unit in which data is stored. Each cell has a unique cell reference (or cell address) made from its column letter and row number, such as B2, which identifies its position exactly.

Types of Data in a Cell

A cell can hold three kinds of data. A label (or text) is words used for headings and names, such as 'Marks'. A value is a number that can be used in calculations, such as 80. A formula is an instruction, beginning with an equals sign, that tells the spreadsheet to calculate a result, such as =B2+B3. The spreadsheet automatically shows the result of a formula in the cell.

Formulas and Functions

The great power of a spreadsheet comes from formulas, which perform calculations using the values in other cells. A formula always starts with an equals sign and can use cell



references and the arithmetic operators + - * /. A function is a ready-made formula for a common calculation; for example, =SUM(B2:B5) adds a range of cells and =AVERAGE(B2:B5) finds their average. Because formulas use cell references, if a value is changed the results are recalculated automatically.

Formatting and Charts

Like a word processor, a spreadsheet can format its data to make it clear: the font, size, colour, alignment and number format (such as currency or decimal places) of cells can be changed, and borders and shading added. A very useful feature is the ability to draw charts and graphs, such as bar charts, line graphs and pie charts, from the data in the cells, which show the information visually and make trends and comparisons easy to see.

Automatic Recalculation

One of the most valuable features of a spreadsheet is automatic recalculation. Because formulas refer to cells rather than to fixed numbers, whenever the contents of a cell are changed, every formula that depends on that cell is worked out again instantly. This makes it easy to try out different figures and see the effect at once, which is why spreadsheets are so useful for 'what-if' calculations such as budgets and forecasts.

Uses of Spreadsheets

Spreadsheets are used wherever numbers must be stored and calculated. Common uses include keeping accounts and budgets, preparing bills and payrolls, recording and analysing students' marks, maintaining inventories, and producing charts and reports. Their ability to calculate automatically, recalculate when data changes, and present data as charts makes them one of the most widely used kinds of application software.

Important Definitions

Term	Definition
Spreadsheet	Software that organises data in a grid and calculates automatically.
Worksheet	The grid of rows and columns in which data is entered.
Cell	The box where a row and a column meet; the basic unit of a worksheet.
Cell reference	The address of a cell made from its column letter and row number (e.g. B2).
Label	Text data used for headings and names.
Value	A number that can be used in calculations.
Formula	An instruction beginning with = that calculates a result.
Function	A ready-made formula such as SUM or AVERAGE.



Key Facts & Rules

Item	Detail
Cell reference	Column letter + row number (e.g. B2)
Formula	Starts with = (e.g. =B2+B3)
SUM	=SUM(B2:B5) adds a range of cells
AVERAGE	=AVERAGE(B2:B5) finds the mean
Operators	+ - * /
Recalculation	Formulas update automatically when data changes

Diagrams & Illustrations

A spreadsheet grid: a worksheet with lettered columns and numbered rows, with the cell B2 highlighted to show a cell reference.

A Spreadsheet (Worksheet)

	A	B	C	D
1				
2		B2		
3				
4				

Columns (A, B...) x Rows (1, 2...) = Cells (e.g. B2)

A spreadsheet grid

Formulas and functions: a small table where a =SUM formula adds two marks and shows the total automatically.



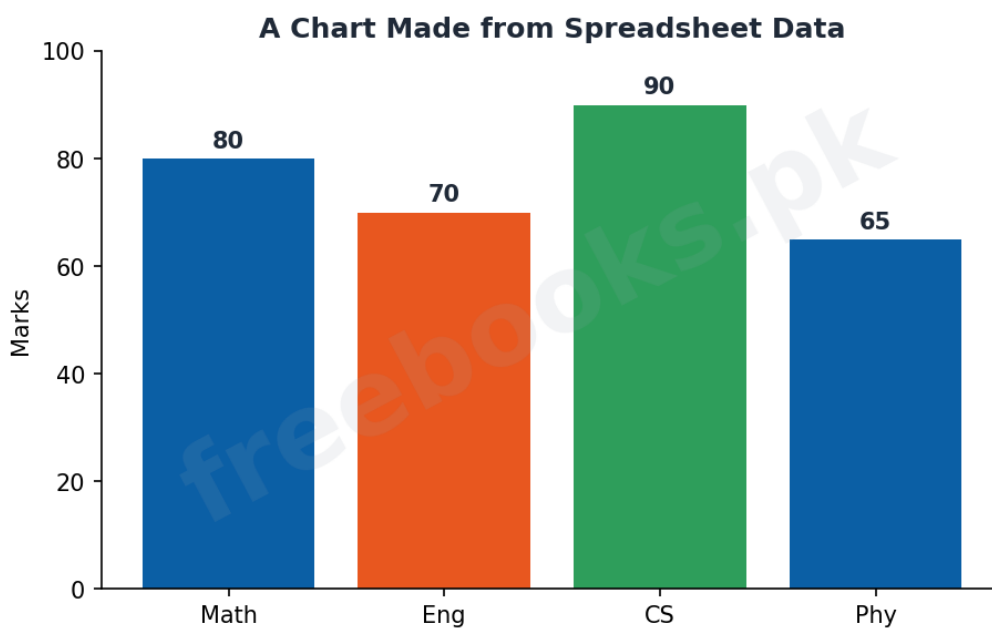
Formulas and Functions

Item	Marks
Math	80
English	70
Total	=SUM(B2:B3)

A formula (=SUM) calculates automatically -> answer 150

Formulas and functions

A chart from data: a bar chart drawn from spreadsheet data showing the marks in several subjects.



A chart from data

Solved Examples & Practice

Write a cell reference

The cell in column C and row 4 has the reference C4.

Add with a function

To add the numbers in cells B2 to B5, use the formula =SUM(B2:B5).



Find an average

To find the average of B2 to B5, use `=AVERAGE(B2:B5)`.

Automatic recalculation

If B2 is changed from 80 to 90, any formula using B2 (such as a total) updates by itself at once.

Short Questions & Answers

Q1. What is a spreadsheet?

Ans. Application software that organises data in a grid of rows and columns and performs calculations automatically (e.g. MS Excel).

Q2. What is a cell?

Ans. The box where a row and a column meet; it is the basic unit in which data is stored, with a reference like B2.

Q3. Name the three types of data in a cell.

Ans. A label (text), a value (number) and a formula.

Q4. What is a formula?

Ans. An instruction that begins with an equals sign and tells the spreadsheet to calculate a result, such as `=B2+B3`.

Q5. What is the SUM function?

Ans. A ready-made function that adds the values in a range of cells, for example `=SUM(B2:B5)`.

Q6. Why is automatic recalculation useful?

Ans. Because when a value is changed, all formulas that use it are worked out again instantly, without retyping them.

Long Questions & Answers

Q1: Describe the structure of a spreadsheet, including cells, rows, columns and cell references, and the types of data a cell can hold.

A spreadsheet is application software used to store data, chiefly numbers, in a grid and to carry out calculations on it automatically; a well-known example is Microsoft Excel. The area in which the user works is called a worksheet, and it is a large grid divided into columns and rows. The columns run vertically down the screen and are labelled with letters, A, B, C and so on, while the rows run horizontally across the screen and are labelled with numbers, 1, 2, 3 and so on. The small rectangular box formed where a particular column crosses a particular row is called a cell, and it is the basic unit of the worksheet in which a single item of data is stored. Every cell has its own unique cell reference, also called a cell address, which is made up of the letter of its column followed by the number of its row; for example, the cell in column B and row 2 has the reference B2, and this reference identifies the cell's exact



position so that it can be used in calculations. Each cell may contain one of three kinds of data. A label, or text, is words such as a heading or a name, for example 'Marks' or 'English'; labels cannot be used in calculations. A value is a number, such as 80, which can be used in calculations. A formula is an instruction, which always begins with an equals sign, that tells the spreadsheet to calculate a result using the contents of other cells, for example $=B2+B3$; the spreadsheet works out the formula and displays the answer in the cell. This orderly structure of labelled cells is what allows a spreadsheet to organise data neatly and to calculate on it.

Q2: Explain formulas, functions and automatic recalculation in a spreadsheet.

The real power of a spreadsheet comes from its ability to perform calculations by means of formulas. A formula is an instruction entered into a cell that begins with an equals sign and tells the spreadsheet how to calculate a value; it can contain numbers, cell references and the arithmetic operators plus (+), minus (-), multiply (*) and divide (/). For example, the formula $=B2+B3$ adds the contents of cells B2 and B3, and $=B2*C2$ multiplies them. The key point is that a formula normally refers to other cells rather than to fixed numbers, so it always uses whatever values those cells currently hold. For common calculations, the spreadsheet provides ready-made formulas called functions, which save the user from writing long formulas; for instance, $=SUM(B2:B5)$ adds up all the values in the range of cells from B2 to B5, and $=AVERAGE(B2:B5)$ finds their average, while other functions find the largest, smallest or count of the values. Because formulas and functions work on cell references, spreadsheets offer an extremely useful feature called automatic recalculation: whenever the number in any cell is changed, every formula that depends on that cell is instantly recalculated and its result updated on the screen, without the user having to do anything. This makes it very easy to explore 'what-if' situations, such as seeing how a total changes when one figure is altered, and it is the reason spreadsheets are so valuable for budgets, accounts and forecasts.

Q3: Describe formatting and charts in a spreadsheet and state the main uses of spreadsheet software.

As well as calculating, a spreadsheet lets the user improve the appearance and usefulness of the data. Through formatting, the font, size, colour and alignment of the text and numbers in cells can be changed, borders and shading can be added to make tables clear, and numbers can be shown in particular formats such as currency, percentages or with a fixed number of decimal places. A particularly valuable feature is the ability to turn the numbers in the worksheet into charts and graphs. From the data in selected cells, the spreadsheet can automatically draw bar charts, line graphs, pie charts and other types of chart, which present the information visually so that trends, patterns and comparisons can be seen at a glance far more easily than from a table of figures; and because the chart is linked to the data, it changes automatically when the data changes. These abilities make spreadsheets useful in a very wide range of situations wherever numbers must be recorded and worked out. They are used for keeping accounts and preparing budgets, for calculating bills and payrolls, for recording and analysing students' examination marks, for maintaining lists of



stock or inventory, and for producing statistical reports and charts. Their combination of neat storage, automatic and instantly updated calculation, and clear visual presentation is why spreadsheet software is one of the most widely used of all application programs, in business, science, education and the home.

MCQs with Answers

1. Software that organises data in a grid and calculates is a:

(a) word processor (b) spreadsheet (c) browser (d) database only

Correct Answer: (b) spreadsheet. A spreadsheet.

2. The grid where data is entered is called a:

(a) desktop (b) worksheet (c) clipboard (d) toolbar

Correct Answer: (b) worksheet. A worksheet.

3. The box where a row and column meet is a:

(a) cell (b) label (c) chart (d) file

Correct Answer: (a) cell. A cell.

4. Columns are usually labelled with:

(a) numbers (b) letters (c) symbols (d) colours

Correct Answer: (b) letters. Letters (A, B, C...).

5. The address B2 is an example of a:

(a) formula (b) cell reference (c) function (d) label

Correct Answer: (b) cell reference. A cell reference.

6. A formula always begins with:

(a) a letter (b) an equals sign (c) a number (d) a space

Correct Answer: (b) an equals sign. An equals sign (=).

7. =SUM(B2:B5) will:

(a) subtract (b) add the range (c) average (d) count only

Correct Answer: (b) add the range. Add the values in the range.

8. Text used for a heading is a:

(a) value (b) label (c) formula (d) chart

Correct Answer: (b) label. A label.

9. When a value changes, formulas are:

(a) deleted (b) recalculated automatically (c) unchanged (d) printed

Correct Answer: (b) recalculated automatically. Recalculated automatically.

10. A bar chart drawn from data is a:

(a) cell (b) formula (c) chart (d) label

Correct Answer: (c) chart. A chart.



Quick Revision Summary

- Spreadsheet = software organising data in a grid + auto calculation (e.g. Excel); worksheet = the grid.
- Columns (letters) x rows (numbers) = cells; cell reference like B2.
- Cell data: label (text), value (number), formula (starts with =).
- Functions: =SUM(range), =AVERAGE(range); operators + - * /.
- Formatting + charts (bar/line/pie); automatic recalculation when data changes.
- Uses: accounts, budgets, payroll, marks, inventory, reports. Notes by freebooks.pk.

Exam Tips

- Define spreadsheet, worksheet and cell.
- Explain a cell reference (column letter + row number).
- List the three types of cell data.
- Write a formula and a function (=SUM, =AVERAGE).
- State why automatic recalculation is useful.
- Give real uses of spreadsheets.

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1st Year Computer Science — Punjab Board

CHAPTER 10

Fundamentals of the Internet

Key Concepts • Definitions • Short & Long Questions • MCQs • Diagrams • Exam Tips

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This chapter covers the Fundamentals of the Internet from the 1st Year (ICS Part-I) Computer Science syllabus of the Punjab Curriculum and Textbook Board (PTB/PCTB). It explains the Internet and how to connect to it, the World Wide Web, web browsers, URLs, search engines and the main Internet services. These notes are prepared by freebooks.pk.

The Internet connects billions of computers around the world and has changed the way we communicate, learn and do business. This chapter explains what the Internet is and how we use it.

Learning Objectives

- Explain what the Internet is and how it is used.
- Describe how a computer connects to the Internet.
- Explain the World Wide Web, web pages and websites.
- Describe a web browser, a URL and a search engine.
- List the main services provided by the Internet.
- State the advantages and drawbacks of the Internet.

Key Concepts

The Internet

The Internet is a huge worldwide network that connects millions of computers and smaller networks together so that they can share information. No single person or organisation owns it; instead, many networks are joined together and communicate using agreed rules (protocols such as TCP/IP). Through the Internet, users all over the world can send messages, share files and access an enormous amount of information at any time.

Connecting to the Internet

To use the Internet, a computer must connect to it through an Internet Service Provider (ISP), a company that provides Internet access. The connection is usually made through a modem or router, which links the computer to the ISP over a telephone line, cable, fibre or wireless link. The ISP then connects the user to the rest of the Internet. Each computer on the Internet is identified by a unique number called an IP address.

The World Wide Web

The World Wide Web (WWW), often just called the Web, is the huge collection of linked documents, called web pages, stored on computers all over the Internet. A group of related web pages belonging to one person or organisation is called a website. Web pages can contain text, pictures, sound and video, and they are joined to one another by hyperlinks, which the user clicks to jump from one page to another. The Web is the most popular part of the Internet.



Web Browsers and URLs

A web browser is application software used to view web pages, such as Google Chrome, Microsoft Edge or Mozilla Firefox. To visit a particular web page, the user enters its address, called a URL (Uniform Resource Locator), into the browser; a URL such as <https://www.freebooks.pk/> has parts that identify the protocol, the domain name of the website and the particular page. The browser then fetches the page from the web server that stores it and displays it on the screen.

Search Engines

Because there are billions of web pages, a search engine is used to find information on the Web. A search engine, such as Google, is a website that lets the user type in keywords describing what they are looking for and then lists the web pages that match, so that the user can click on the most useful ones. Search engines make the vast amount of information on the Internet easy to find.

Internet Services

The Internet provides many useful services. Electronic mail (e-mail) allows messages and files to be sent quickly. The World Wide Web gives access to information on almost any subject. File transfer allows files to be uploaded and downloaded. Other services include online chat and video calls, social media, online shopping and banking (e-commerce), online education, and entertainment such as music and video streaming. These services have made the Internet part of everyday life.

Advantages and Drawbacks of the Internet

The Internet has many advantages: it gives fast access to a vast amount of information, allows quick and cheap communication worldwide, supports business and education, and provides entertainment. However, it also has drawbacks: it can spread viruses, expose users to unsuitable or false information, threaten privacy and security, and lead to time-wasting or addiction. Users should therefore use the Internet responsibly and safely.

Important Definitions

Term	Definition
Internet	A worldwide network connecting millions of computers to share information.
ISP	Internet Service Provider; a company that provides Internet access.
IP address	A unique number that identifies a computer on the Internet.
World Wide Web	The collection of linked web pages stored on the Internet.
Website	A group of related web pages belonging to one person or organisation.
Web browser	Software used to view web pages (e.g. Chrome).
URL	The address of a web page (Uniform Resource Locator).



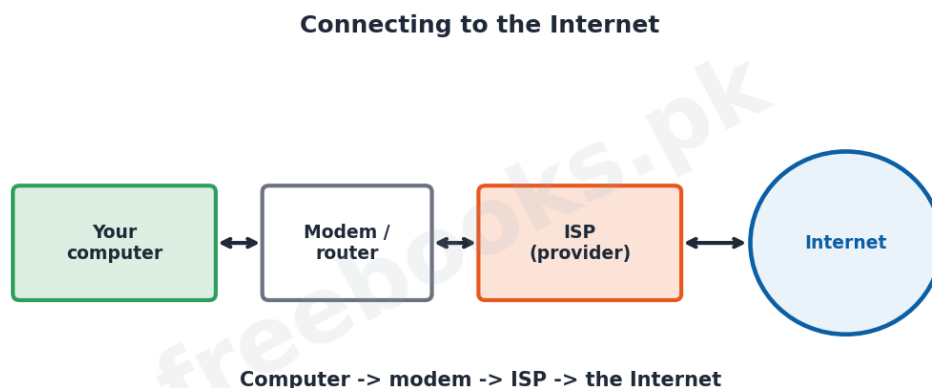
Term	Definition
Search engine	A website that finds web pages matching keywords (e.g. Google).

Key Facts & Rules

Item	Detail
Connection	Computer -> modem/router -> ISP -> Internet
IP address	Unique number identifying each computer
WWW	Web pages linked by hyperlinks
Website	A group of related web pages
URL	protocol + domain name + path
Search engine	Find pages by keywords (e.g. Google)

Diagrams & Illustrations

Connecting to the Internet: a computer linked through a modem/router and an ISP to reach the Internet.



Connecting to the Internet

Parts of a URL: a URL broken into its protocol, domain name and path.

Parts of a URL (Web Address)

https://www.freebooks.pk/notes/



A URL is the unique address of a web page



Requesting a web page: a web browser (client) sending a request to a web server, which returns the web page.

How a Web Page is Requested



Requesting a web page

Solved Examples & Practice

Identify the service

Sending a message with a file attached to a friend uses the e-mail service of the Internet.

Find information

To find pages about the solar system, type the keywords into a search engine such as Google.

Read a URL

In `https://www.freebooks.pk/notes/`, 'https' is the protocol, 'www.freebooks.pk' is the domain name and '/notes/' is the path.

Connect a computer

A home computer connects to the Internet through a modem/router and an Internet Service Provider (ISP).

Short Questions & Answers

Q1. What is the Internet?

Ans. A huge worldwide network that connects millions of computers so that they can share information.

Q2. What is an ISP?

Ans. An Internet Service Provider, a company that provides access to the Internet.

Q3. What is the World Wide Web?



Ans. The collection of linked web pages, stored on computers across the Internet, joined by hyperlinks.

Q4. What is a web browser?

Ans. Application software used to view web pages, such as Google Chrome or Firefox.

Q5. What is a URL?

Ans. The unique address of a web page, for example <https://www.freebooks.pk/>.

Q6. What is a search engine?

Ans. A website, such as Google, that finds web pages matching the keywords the user types.

Long Questions & Answers

Q1: Explain what the Internet is and describe how a computer connects to it.

The Internet is a vast, worldwide network that links millions of computers and thousands of smaller networks together so that they can communicate and share information. It is not owned or controlled by any single person or company; rather, it is made up of many independent networks that agree to connect to one another and to communicate using a common set of rules, or protocols, the most important of which is TCP/IP. Because of this, a user sitting at one computer can exchange information with computers almost anywhere in the world. To make use of the Internet, an ordinary computer must first be connected to it, and this is done through an Internet Service Provider (ISP), which is a company that sells Internet access to homes and businesses. The physical connection between the user's computer and the ISP is usually made through a device called a modem or a router, which links the computer to the ISP over a telephone line, a cable, a fibre-optic line or a wireless link. The ISP is itself connected to the wider Internet, so once the user reaches the ISP they can reach the whole Internet. So that data can be sent to the right place, every computer connected to the Internet is given a unique identifying number called an IP address, rather like a postal address, which allows information to be delivered to exactly the right machine. In this way an individual computer becomes part of the global network.

Q2: Describe the World Wide Web, web browsers, URLs and search engines.

The World Wide Web, usually shortened to the Web, is the most widely used part of the Internet. It is the enormous collection of electronic documents, called web pages, that are stored on computers all over the world and are linked to one another. A web page may contain text, pictures, sound and video, and it contains hyperlinks, special words or images that the user can click to jump straight to another related page. A set of web pages that belong to one person or organisation and are kept together is called a website. To look at web pages, the user needs a piece of application software called a web browser; common browsers include Google Chrome, Microsoft Edge and Mozilla Firefox. Every web page has a unique address called a URL, which stands for Uniform Resource Locator; a URL such as



<https://www.freebooks.pk/notes/> is made up of parts that tell the browser the protocol to use, the domain name of the website, and the particular page or folder that is wanted. When the user types a URL into the browser (or clicks a hyperlink), the browser sends a request to the web server that stores that page, and the server sends the page back so that the browser can display it. Because the Web contains billions of pages, finding a particular piece of information would be impossible without help, and this is provided by a search engine such as Google, which is a special website where the user types in keywords describing what they want; the search engine then lists the web pages that best match those keywords, and the user simply clicks on the most useful ones. Together, browsers, URLs and search engines make the huge information of the Web easy to reach.

Q3: Describe the main services provided by the Internet and discuss its advantages and drawbacks.

The Internet is valuable because of the many services it provides. Electronic mail (e-mail) lets users send written messages, together with attached files such as documents and pictures, to anyone in the world within seconds. The World Wide Web gives access to a practically unlimited store of information on every imaginable subject, used for study, research and news. File transfer allows files to be downloaded from, and uploaded to, computers across the Internet. In addition, the Internet supports instant messaging, online chat and video calls that let people talk face to face across great distances; social media for keeping in touch and sharing; e-commerce, that is, online shopping and banking; online education and examinations; and entertainment such as games and the streaming of music and films. These services have made the Internet a part of daily life. The Internet brings great advantages: it provides fast and cheap communication across the world, immediate access to a vast amount of information, support for business and education, and a wide range of entertainment. However, it also has serious drawbacks that users must be aware of. It can be used to spread computer viruses and other harmful programs; it exposes users, especially children, to unsuitable, harmful or false information; it can threaten people's privacy and the security of their personal and financial data through hacking and fraud; and spending too much time online can waste time and even become an addiction. For these reasons, while the Internet is an extremely powerful and useful tool, it should always be used carefully, responsibly and safely.

MCQs with Answers

1. A worldwide network of connected computers is the:

(a) LAN (b) Internet (c) hub (d) modem

Correct Answer: (b) Internet. The Internet.

2. A company that provides Internet access is an:

(a) ISP (b) OS (c) IP (d) URL

Correct Answer: (a) ISP. ISP (Internet Service Provider).

3. A unique number identifying a computer on the Internet is an:

(a) IP address (b) icon (c) index (d) opcode

Correct Answer: (a) IP address. IP address.



4. Linked web pages across the Internet form the:

(a) LAN (b) World Wide Web (c) modem (d) ISP

Correct Answer: (b) World Wide Web. The World Wide Web.

5. Software used to view web pages is a:

(a) web browser (b) spreadsheet (c) compiler (d) modem

Correct Answer: (a) web browser. A web browser.

6. The address of a web page is its:

(a) IP (b) URL (c) ISP (d) OS

Correct Answer: (b) URL. URL.

7. A group of related web pages is a:

(a) website (b) cell (c) folder only (d) protocol

Correct Answer: (a) website. A website.

8. Google is an example of a:

(a) web browser (b) search engine (c) modem (d) spreadsheet

Correct Answer: (b) search engine. A search engine.

9. Clickable links between web pages are:

(a) hyperlinks (b) cells (c) icons (d) cookies

Correct Answer: (a) hyperlinks. Hyperlinks.

10. A drawback of the Internet is:

(a) fast information (b) spread of viruses (c) cheap communication (d) entertainment

Correct Answer: (b) spread of viruses. The spread of viruses (and unsafe content).

Quick Revision Summary

- Internet = worldwide network of computers sharing information (uses TCP/IP).
- Connect via modem/router + ISP; each computer has an IP address.
- WWW = linked web pages; a website = related pages; hyperlinks connect them.
- Web browser (Chrome) views pages; URL = page address; search engine (Google) finds pages.
- Services: e-mail, Web, file transfer, chat, social media, e-commerce, education.
- Advantages: fast info + communication; drawbacks: viruses, unsafe content, privacy risks. Notes by freebooks.pk.

Exam Tips

- Define the Internet and the WWW (they are not the same).
- Explain connecting via ISP and modem; mention IP address.
- Define web browser, URL and search engine.
- List the main Internet services.
- Read the parts of a URL.
- Give balanced advantages and drawbacks of the Internet.



