9th Class Computer Science Notes - Complete Chapter-wise Study Guide (Punjab, 2026-27)

9th Class - Punjab Board - Session 2026-27

Original study notes by Zahid Notes for revision. These are summaries, not the official textbook.

How to use these notes: These 9th class computer science notes are original summaries written in simple words. They are meant for revision and understanding - read the chapter summary first, then practise the short and long questions, and finally test yourself with the MCQs. They are not a copy of any textbook. Students revising with these 9th class computer science notes should work through one chapter at a time rather than trying to memorise the whole book at once. Punjab-wide only: no board-specific claims are made anywhere in this draft.

Chapter 1: Introduction to Computational Systems

Summary

A computational system is a complete working setup in which hardware, software, data and users work together to solve a problem. A computer on its own is only hardware; it becomes a computational system when programs run on it, data flows through it, and a user gives it a purpose. Every computational system follows the IPO cycle: Input, Process, Output. Data is raw, unorganised facts, while information is data that has been processed into a meaningful and useful form.

The hardware of a system is its physical parts: input devices (keyboard, mouse, scanner, microphone), output devices (monitor, printer, speaker), the central processing unit or CPU (the brain of the computer, made up of the arithmetic logic unit, the control unit, and registers), and memory/storage. Memory is of two main kinds: primary memory, which the CPU uses directly while working (RAM, which is temporary and lost when power goes off, and ROM, which is permanent), and secondary storage, which keeps data for a long time (hard disk, SSD, USB flash drive, optical disc).

Software is divided into system software and application software. System software manages the computer itself: the operating system is the main example, and it acts as a bridge between the user and the hardware, managing the processor, memory, files and devices, and providing the environment in which other programs run. The core part of the operating system that stays in memory is called the kernel, and the user works through either a graphical user interface (GUI: icons, windows and menus) or a command-line interface (CLI: typed text commands). Application software is made for a specific user task. Common examples are word processors for writing documents, spreadsheets for organising data in rows and columns and calculating with formulas and functions, presentation software for making slides, and web browsers for viewing web pages.

Computers are also classified by size and power - from small personal computers and laptops, through workstations and servers, to very large mainframes and supercomputers. A computer works with binary digits, or bits: a 0 or a 1. Eight bits make one byte, and larger units such as kilobytes, megabytes, gigabytes and terabytes measure larger amounts of data.

Key definitions and concepts

- **Computational system:** Hardware, software, data and users working together to process information and solve a problem.
- **Computer:** An electronic device that accepts data, processes it, and produces meaningful output.
- **Data vs information:** Data is raw facts; information is processed data that is useful for making a decision.
- **Hardware:** The physical, touchable parts of a computer system.
- **Software:** The set of programs and instructions that control the hardware.
- **CPU:** The central processing unit; it carries out instructions and controls the other parts of the computer.
- **ALU:** The arithmetic logic unit; it performs calculations and logical comparisons.
- **RAM:** Random access memory; fast, temporary memory that holds data while the computer is running.

- **ROM:** Read-only memory; permanent memory that holds the start-up instructions.
- **Operating system:** System software that manages computer hardware and provides a platform for application programs.
- **Kernel:** The core part of the operating system that manages the processor, memory and devices.
- **GUI / CLI:** Graphical user interface (icons, windows, menus) / command-line interface (typed text commands).
- **Bit and byte:** A bit is a single binary digit (0 or 1); eight bits make one byte.

Important short questions

Q1. What is a computational system?

A computational system is a complete setup in which hardware, software, data and users work together to process information and solve a problem.

Q2. What is the difference between data and information?

Data is raw and unorganised facts, such as a list of marks. Information is data after processing, such as a student's average mark, which is meaningful and useful.

Q3. What is the difference between RAM and ROM?

RAM is temporary memory that loses its contents when the computer is switched off, while ROM is permanent memory that keeps its contents even without power.

Q4. What is the difference between system software and application software?

System software manages the computer itself, such as the operating system. Application software is made for a specific user task, such as a word processor, a spreadsheet or a web browser.

Important long questions

Q1. Explain the IPO cycle with an example.

The IPO cycle has three stages. Input: the user enters data, for example typing marks on a keyboard. Process: the CPU works on the data, for example adding the marks to find a total. Output: the result is shown, for example the total displayed on the monitor. Storage may also be used to save the result for later use.

Q2. Explain the main functions of an operating system.

An operating system manages the processor (deciding which program runs and when), memory (giving each program the memory it needs and keeping programs from interfering with each other), files (organising files and folders on storage), and devices (communicating with hardware through drivers). It also provides the user interface through which the user controls the computer.

MCQs

1. Which of the following is an input device?

a) Monitor b) Printer c) Keyboard d) Speaker

2. Which unit performs arithmetic calculations in the CPU?

a) CU b) ALU c) RAM d) ROM

3. How many bits make one byte?

a) 2 b) 4 c) 8 d) 16

4. Which memory is lost when the computer is switched off?

a) ROM b) Hard disk c) RAM d) USB drive

Answer key: 1-c, 2-b, 3-c, 4-c

Chapter 2: System Design and Troubleshooting

Summary

A system is a set of parts that work together to achieve a goal - for example, a school's result system, in which teachers enter marks, the computer processes them, and report cards are produced. System design means planning how such a system will work before it is built: what it must do, what inputs it needs, what outputs it must produce, and how users will interact with it. Good design starts from the users' needs, keeps the interface simple and clear, and plans for security and for future changes.

Building a system usually follows a sequence of stages called the system development life cycle (SDLC): planning (deciding what problem the system must solve and whether it is worth building), analysis (studying the current way of working and listing the requirements), design (deciding the inputs, outputs, storage and interface), implementation (building and installing the system), testing (checking that it works correctly), deployment (putting it into real use), and maintenance (fixing problems and improving it over time).

Testing is done before a system is trusted: small parts are tested on their own (unit testing), then parts are tested together (integration testing), then the whole system is tested (system testing), and finally the users confirm it meets their needs (acceptance testing). Even after deployment, systems develop problems, and troubleshooting is the systematic way of fixing them: first identify the problem clearly, then gather information (what changed recently, what error messages appear), then form a likely cause, test the fix, verify that the problem is gone, and record what was done. Common problems have common causes: a computer that will not start may have a power or cable problem; a slow computer may be running too many programs or running low on storage; a missing internet connection may be a router, cable or settings problem; a printer that will not print may have a connection or driver problem; a program that crashes may need an update or reinstallation. Regular updates, backups and antivirus protection prevent many problems before they occur.

Key definitions and concepts

- **System:** A set of related parts working together to achieve a goal.

- **System design:** Planning how a system will work - its inputs, outputs, storage, processing and user interface - before it is built.
- **SDLC:** System development life cycle; the stages of planning, analysis, design, implementation, testing, deployment and maintenance.
- **User interface:** The part of a system through which users interact with it, such as screens, menus and buttons.
- **Testing:** Checking a system or its parts to find and fix errors before and after deployment.
- **Unit / integration / system / acceptance testing:** Testing a small part alone; testing parts together; testing the whole system; testing by users to confirm it meets their needs.
- **Troubleshooting:** A step-by-step method of finding the cause of a problem and fixing it.
- **Maintenance:** Keeping a working system running by fixing faults and making improvements over time.

Important short questions

Q1. What is a system? Give one example.

A system is a set of related parts working together to achieve a goal. Example: a school result system, in which marks are entered, processed, and printed as report cards.

Q2. Name the stages of the system development life cycle in order.

Planning, analysis, design, implementation, testing, deployment and maintenance.

Q3. What is the purpose of testing a system?

Testing finds errors before the system is trusted in real use, so that faults can be fixed while they are still cheap and safe to fix.

Q4. What is the first step of troubleshooting?

Identifying the problem clearly - what exactly is wrong, when it started, and what has changed since it last worked.

Important long questions

Q1. Explain the stages of the system development life cycle.

Planning decides what problem the system must solve. Analysis studies the current way of working and lists the requirements. Design decides the inputs, outputs, storage and interface. Implementation builds and installs the system. Testing checks that it works correctly. Deployment puts it into real use. Maintenance keeps it running by fixing faults and improving it over time.

Q2. Explain the troubleshooting process with an example.

Suppose a computer has no internet. First identify the problem: no web pages open, but other programs work. Then gather information: check whether other devices have internet, look at the router lights, and check cables. Then form a likely cause, such as a loose cable or a switched-off router. Test the fix: reconnect the cable or restart the router. Then verify that web pages open again, and record what was done so the same fix can be used next time.

MCQs

1. Which is the first stage of the system development life cycle?

a) Testing b) Design c) Planning d) Maintenance

2. Testing small parts of a system on their own is called:

a) System testing b) Unit testing c) Acceptance testing d) Deployment

3. The first step of troubleshooting is to:

a) Replace the computer b) Identify the problem clearly c) Reinstall everything d) Ignore the error

4. Fixing faults and improving a working system over time is called:

a) Analysis b) Design c) Maintenance d) Deployment

Answer key: 1-c, 2-b, 3-b, 4-c

Chapter 3: Introduction to Computer Networks

Summary

Data communication is the exchange of data between two or more devices through a transmission medium, such as a cable or wireless signals. For communication to work, a sender, a receiver, a message, a medium, and an agreed set of rules (a protocol) are needed. Data can travel in one direction only (simplex, like a television broadcast), in both directions but one at a time (half-duplex, like a walkie-talkie), or in both directions at the same time (full-duplex, like a telephone call).

A computer network is a group of computers and devices connected together so they can share data and resources, such as files, printers and internet connections. Networks are classified by size: a PAN (personal area network) covers a very small area around a person, a LAN (local area network) covers a building or campus, a MAN (metropolitan area network) covers a city, and a WAN (wide area network) covers a large region or the whole world - the internet is the largest example of a WAN.

Devices are connected in different layouts called topologies: in a bus topology all devices share one main cable; in a star topology all devices connect to a central device such as a switch; in a ring topology each device connects to two neighbours forming a circle; and in a mesh topology devices have multiple connections to each other. Common network devices include modems, switches, routers and network interface cards (NICs). The internet is a worldwide network of networks, and the World Wide Web is the system of linked web pages accessed over the internet using browsers.

Key definitions and concepts

- **Data communication:** The transfer of data between a sender and a receiver through a medium.

- **Protocol:** A set of agreed rules that controls how data is sent and received.
- **Simplex / half-duplex / full-duplex:** One-way communication; two-way communication one direction at a time; two-way communication both directions at once.
- **LAN:** A network covering a small area such as a home, office or school.
- **WAN:** A network covering a large geographical area, such as a country or the world.
- **Topology:** The physical layout or arrangement of devices in a network.
- **Router:** A device that connects different networks and forwards data between them.
- **Internet vs World Wide Web:** The internet is the network itself; the web is the collection of linked pages and content accessed over it.

Important short questions

Q1. What is data communication?

Data communication is the exchange of data between two devices through a transmission medium, following agreed rules.

Q2. What is the difference between a LAN and a WAN?

A LAN covers a small area such as a building or campus, while a WAN covers a large area such as a city, country or the whole world.

Q3. What is a protocol? Give an example.

A protocol is a set of rules for how data is sent and received. An example is HTTP, the protocol used for transferring web pages.

Q4. What is the difference between the internet and the World Wide Web?

The internet is the worldwide network of connected computers, while the World Wide Web is the system of linked web pages and content that is accessed over the internet.

Important long questions

Q1. Explain simplex, half-duplex and full-duplex communication with one example of each.

Simplex: data flows in one direction only, for example a television broadcast. Half-duplex: data flows in both directions but only one direction at a time, for example a walkie-talkie. Full-duplex: data flows in both directions at the same time, for example a telephone conversation.

Q2. Compare star and bus topologies, including one advantage of each.

In a bus topology all devices share a single main cable, which is cheap and simple to set up, but a fault in the main cable can stop the whole network. In a star topology every device connects to a central switch, so one device failing does not stop the others, but the network depends on the central device working.

MCQs

1. Which network covers the smallest area?

a) WAN b) MAN c) LAN d) PAN

2. In which topology do all devices connect to a central switch?

a) Bus b) Ring c) Star d) Mesh

3. A telephone conversation is an example of which mode?

a) Simplex b) Half-duplex c) Full-duplex d) None of these

4. Which device connects different networks together?

a) Printer b) Router c) Monitor d) Speaker

Answer key: 1-d, 2-c, 3-c, 4-b

Chapter 4: Computational Thinking

Summary

Computational thinking is a way of solving problems using ideas from computer science. It does not mean thinking like a machine; it means approaching a problem in an organised way that a computer could later carry out. It rests on four pillars. Decomposition means breaking a large problem into smaller, manageable parts - for example, planning a school function by dividing it into venue, invitations, food and programme. Pattern recognition means noticing similarities between problems, so a solution that worked before can be reused. Abstraction means keeping only the details that matter for the problem and ignoring the rest - for example, a map for a journey shows roads and distances but not every tree. Algorithm design means writing the solution as a clear, step-by-step procedure.

The problem-solving process itself has clear steps: first understand the problem, then plan a solution (as an algorithm), then implement it, then test it, and finally improve it if needed. An algorithm is a finite, step-by-step procedure for solving a problem, written so that it has a definite starting point, a finite number of steps, and a definite result. Algorithms can be expressed in plain language steps, in pseudocode (a simple, code-like way of writing steps without strict programming rules), or in a flowchart (the same logic shown as a diagram). Flowcharts use standard shapes: an oval for start and stop, a parallelogram for input and output, a rectangle for a process or calculation, and a diamond for a decision, with arrows showing the direction of flow.

To turn an algorithm into a working program, programming languages are used. Low-level languages are close to machine language (binary 0s and 1s) and run fast but are hard for humans to write, while high-level languages (such as Python, C++ and Java) use words closer to human language and are easier to learn, though they must be translated into machine language by a compiler (which translates the whole program at once) or an interpreter (which translates and runs it line by line). A program works with data stored in variables (named storage locations whose value can change) and constants (values that do not change). Common data types include integers (whole numbers), real or floating-point numbers (numbers with decimal points), characters (single letters or symbols), and strings (sequences of characters). The basic building blocks of a program are sequence (steps in order), selection (choosing between paths with a condition, such as if-else), and repetition or loops (repeating steps while a condition holds). Errors in programs are called bugs, and finding and fixing them is called debugging.

Key definitions and concepts

- **Computational thinking:** An organised way of solving problems using decomposition, pattern recognition, abstraction and algorithm design.
- **Decomposition:** Breaking a large problem into smaller, manageable parts.
- **Pattern recognition:** Noticing similarities between problems so earlier solutions can be reused.
- **Abstraction:** Keeping only the important details of a problem and ignoring the rest.
- **Algorithm:** A finite, step-by-step procedure for solving a problem.
- **Pseudocode:** Writing an algorithm in simple, code-like steps without strict programming rules.
- **Flowchart:** A diagram that represents the steps of an algorithm using standard symbols.
- **Program:** A set of instructions that tells a computer how to perform a task.
- **Variable:** A named storage location whose value can change during a program.

- **Constant:** A value that does not change while the program runs.
- **Compiler:** A translator that converts a whole high-level program into machine language at once.
- **Interpreter:** A translator that converts and executes a high-level program line by line.
- **Debugging:** The process of finding and correcting errors (bugs) in a program.

Important short questions

Q1. What is computational thinking?

Computational thinking is an organised way of solving problems using decomposition, pattern recognition, abstraction and algorithm design, so that the solution can be carried out step by step.

Q2. What is decomposition? Give an example.

Decomposition is breaking a large problem into smaller parts. Example: planning a school function by dividing it into venue, invitations, food and programme.

Q3. What is an algorithm?

An algorithm is a clear, finite, step-by-step procedure for solving a problem, with a definite start and a definite result.

Q4. What is the difference between a compiler and an interpreter?

A compiler translates the entire program into machine language before running it, while an interpreter translates and runs the program one line at a time.

Important long questions

Q1. Explain the four pillars of computational thinking with one example each.

Decomposition: breaking a big problem into small parts, such as dividing exam preparation into one chapter at a time. Pattern recognition: noticing that two problems are similar, such as using the same method to find the average of any list of numbers. Abstraction: keeping only the important details, such as a class timetable showing subjects and times but not every classroom detail. Algorithm design: writing the solution as clear steps, such as the steps for finding the largest of three numbers.

Q2. Explain the main flowchart symbols and their uses.

An oval shows the start or end of a flowchart. A parallelogram shows input or output. A rectangle shows a process, such as a calculation or assignment. A diamond shows a decision, where the flow branches depending on whether a condition is true or false. Arrows show the direction of flow between steps.

MCQs

1. A step-by-step procedure for solving a problem is called a/an:

a) Program b) Algorithm c) Variable d) Bug

2. Which flowchart symbol is used for a decision?

a) Oval b) Rectangle c) Diamond d) Parallelogram

3. Which translator converts the whole program at once?

a) Interpreter b) Compiler c) Assembler d) Debugger

4. An error in a program is called a:

a) Virus b) Bug c) Byte d) Bit

Answer key: 1-b, 2-c, 3-b, 4-b

Chapter 5: Web Development with HTML, CSS and JavaScript

Summary

Web development means building websites and web applications. A website is a collection of related web pages, and a web page is a single document viewed in a browser. A browser (such as Chrome, Firefox or Edge) reads web files and displays them to the user. Web pages are linked to each other with hyperlinks, so a user can move from one page to another by clicking.

Building a web page uses three core technologies, each with its own job. HTML (HyperText Markup Language) gives the page its structure: it marks up content with tags, which are instructions written inside angle brackets. A basic HTML page has a head section (with the page title) and a body section (with the visible content). Common elements include headings (h1 for the largest heading down to h6), paragraphs (p), links (a), images (img) and lists (ul for unordered lists, ol for ordered lists). CSS (Cascading Style Sheets) controls the appearance: colours, fonts, sizes, spacing and layout. CSS can be written inside a single element, inside the page's head section, or in a separate style sheet file that many pages share. JavaScript adds behaviour and interactivity: it can respond to clicks, check what a user types into a form before it is sent, and change page content without reloading the whole page.

A useful way to remember the three roles is that HTML is the skeleton of the page, CSS is its clothing and appearance, and JavaScript is its actions. Together they form the front-end - the part of a website the user sees and interacts with. Behind the scenes, a back-end (programs running on a server) can store data and serve pages, but the front-end is where most beginners start. A web page is built in a text editor and tested in a browser, and it should be responsive, meaning it works well on both a computer screen and a phone screen. Publishing a site for the world to see needs a domain name (the site's address) and hosting (a server computer that stores the site's files and serves them to visitors).

Key definitions and concepts

- **Website:** A collection of related web pages under one address.

- **Web page:** A single document viewed in a browser.
- **Browser:** Software that reads web files and displays them as pages.
- **Hyperlink:** A clickable link that takes the user from one page or resource to another.
- **HTML:** HyperText Markup Language; the language that gives a web page its structure.
- **Tag / element:** A markup instruction in angle brackets (such as p or h1) / a tag together with its content.
- **CSS:** Cascading Style Sheets; the language that controls a page's colours, fonts, spacing and layout.
- **JavaScript:** A programming language that adds interactivity and behaviour to web pages.
- **Responsive design:** Designing a page so it works well on different screen sizes, including phones.
- **Domain / hosting:** A website's address / a server that stores a site's files and serves them to visitors.

Important short questions

Q1. What are the three core technologies of web development, and what does each do?

HTML gives the page its structure, CSS controls its appearance (colours, fonts, layout), and JavaScript adds interactivity and behaviour.

Q2. What is a tag in HTML?

A tag is a markup instruction written inside angle brackets, such as h1 for a heading or p for a paragraph, that tells the browser how to display content.

Q3. What does a web browser do?

A browser reads web files (HTML, CSS and JavaScript) and displays them to the user as web pages.

Q4. What is a hyperlink?

A hyperlink is a clickable link, usually created with the anchor element, that takes the user from one web page or resource to another.

Important long questions

Q1. Explain the roles of HTML, CSS and JavaScript with a simple page example.

For a page about a school, HTML provides the structure: a heading with the school name, a paragraph describing it, and a list of subjects. CSS provides the appearance: the heading in a dark colour and large font, the paragraph in a readable size, and the list neatly spaced. JavaScript provides the behaviour: a button that shows or hides the subject list when clicked, or a form that checks that the name field is not empty before submitting.

Q2. Describe the basic structure of an HTML page.

An HTML page starts with the html element. Inside it, the head section holds information about the page, such as its title, which appears in the browser tab. The body section holds the visible content: headings, paragraphs, links, images and lists. Tags usually come in opening and closing pairs, with the content between them.

MCQs

1. HTML stands for:

a) HighText Machine Language b) HyperText Markup Language c) Hyperlink Text Mode Language d) Home Tool Markup Language

2. Which technology controls the colours, fonts and layout of a web page?

a) HTML b) JavaScript c) CSS d) HTTP

3. JavaScript is mainly used to add:

a) Structure b) Appearance c) Interactivity d) Storage

4. Which tag is used for the largest heading in HTML?

a) h6 b) head c) h1 d) header

Answer key: 1-b, 2-c, 3-c, 4-c

Chapter 6: Data Science and Data Gathering

Summary

Data science is the field that collects, cleans, analyses and uses data to find useful patterns and support better decisions. It starts from a simple distinction: data is raw facts (for example, a list of students' marks), while information is data that has been processed into a useful form (for example, the class average, which tells the teacher how the class performed).

Data comes in different forms. Structured data is organised in rows and columns, like a marks table, and is easy to search and analyse. Unstructured data has no fixed table shape, like written text, photographs, audio and video. Data can also be quantitative (numbers that can be counted or measured, such as height or marks) or qualitative (descriptions and opinions, such as favourite colours or interview answers).

Good data science begins with good data gathering. Common gathering methods include surveys and questionnaires (written questions given to many people), interviews (asking questions face to face or by phone), observation (watching and recording what happens), sensors and devices (automatic readings, such as a thermometer or a step counter), online forms, and existing records (such as school registers). Good gathering needs clear questions, enough responses to be meaningful, and honest recording - data that is invented or carelessly recorded leads to wrong conclusions.

Before analysis, data is cleaned: duplicate entries are removed, obvious errors are corrected, and missing values are marked or filled sensibly. Analysis itself can be simple: counting, finding averages, sorting, and drawing tables and charts (such as bar charts and pie charts) to make patterns visible. The final step is using the result to make a decision - for example, a school that analyses attendance data may arrange extra classes for students who miss school often. Because data often concerns real people, it must be gathered with permission, kept safe, and shared only as far as needed.

Key definitions and concepts

- **Data science:** Collecting, cleaning, analysing and using data to find patterns and support decisions.
- **Data:** Raw, unorganised facts.
- **Information:** Processed data that is meaningful and useful.
- **Structured data:** Data organised in rows and columns, such as a table.
- **Unstructured data:** Data with no fixed table shape, such as text, images, audio and video.
- **Quantitative data:** Data in numbers that can be counted or measured.
- **Qualitative data:** Data in descriptions, opinions or categories.
- **Survey / questionnaire:** A method of gathering data by asking the same written questions to many people.
- **Observation:** Gathering data by watching and recording what happens.
- **Data cleaning:** Removing duplicates and errors and handling missing values before analysis.

Important short questions

Q1. What is data science?

Data science is the field that collects, cleans, analyses and uses data to find useful patterns and support better decisions.

Q2. What is the difference between data and information?

Data is raw facts, such as a list of marks. Information is processed data, such as the class average, which is meaningful and useful.

Q3. What is the difference between structured and unstructured data?

Structured data is organised in rows and columns, like a marks table. Unstructured data has no fixed table shape, like written text, photographs or videos.

Q4. Why is data cleaning necessary before analysis?

Because raw data may contain duplicates, errors or missing values, and analysing dirty data gives wrong results and wrong decisions.

Important long questions

Q1. Explain four methods of data gathering with one example of each.

Surveys/questionnaires: written questions given to many people, such as a form asking students about their favourite subject. Interviews: asking questions directly, such as a teacher asking students why they find a topic difficult. Observation: watching and recording, such as counting how many students use the library each day. Sensors/devices: automatic readings, such as a thermometer recording the temperature every hour.

Q2. Explain the steps from gathering data to making a decision, with a school example.

First, gather data, such as students' attendance records. Then clean it by removing duplicates and errors. Then analyse it by counting and finding patterns, such as which days have the lowest attendance. Then present it as a table or chart so the pattern is clear. Finally, use it to decide, such as arranging extra classes or speaking to parents of students who miss school often.

MCQs

1. Raw, unorganised facts are called:

a) Information b) Data c) Knowledge d) Charts

2. A questionnaire is a method of:

a) Data cleaning b) Data gathering c) Data storage d) Data deletion

3. Which of the following is structured data?

a) A photograph b) A song c) A marks table d) A speech

4. What is the average of 10, 20 and 30?

a) 10 b) 20 c) 30 d) 60

Answer key: 1-b, 2-b, 3-c, 4-b

Chapter 7: Emerging Technologies in Computer Science

Summary

Emerging technologies are new and fast-growing technologies that are changing how people live, work and learn. They matter for students because the jobs and tools of the coming years will be built on them, and because using them wisely requires understanding both their benefits and their risks.

Artificial intelligence (AI) means machines performing tasks that normally need human-like thinking, such as recognising faces in photographs, understanding spoken language, or answering questions in a chatbot. Machine learning is a part of AI in which a computer learns patterns from examples in data and improves with more examples - for instance, a program that learns to tell spam emails from real ones by studying many examples of each. The Internet of Things (IoT) means everyday devices connected to the internet, such as smart bulbs, fitness bands and home sensors, so they can send and receive data and be controlled remotely.

Cloud computing means using storage and software over the internet instead of only on your own computer - for example, saving documents online so they can be opened from any device. Robotics means machines that perform physical tasks, used in factories, hospitals and exploration of dangerous places. Blockchain is a shared, tamper-resistant digital record in which entries are linked together, so past entries are very hard to change unnoticed. Virtual reality (VR) places the user inside a fully computer-made world, usually with a headset, while augmented reality (AR) overlays digital information on the real world, such as directions shown on a phone camera view. Faster mobile networks, such as 5G, support more connected devices and quicker data transfer.

These technologies bring clear benefits - faster work, better services, new kinds of jobs - but also cautions: they change which skills are needed, they raise questions about privacy and the safety of personal data, and they work best when users understand them rather than trusting them blindly.

Key definitions and concepts

- **Emerging technologies:** New and fast-growing technologies that are changing how people live and work.
- **Artificial intelligence (AI):** Machines performing tasks that normally need human-like thinking, such as recognising images or understanding language.
- **Machine learning:** A part of AI in which a computer learns patterns from examples in data and improves with more examples.
- **Internet of Things (IoT):** Everyday devices connected to the internet so they can send and receive data.
- **Cloud computing:** Using storage and software over the internet instead of only on your own computer.
- **Robotics:** Machines built to perform physical tasks, often automatically.
- **Blockchain:** A shared digital record in which entries are linked together so past entries are very hard to change unnoticed.
- **Virtual reality (VR):** A fully computer-made world the user experiences, usually with a headset.

- **Augmented reality (AR):** Digital information overlaid on the real world, such as directions on a phone camera view.

Important short questions

Q1. What is artificial intelligence? Give one example.

Artificial intelligence means machines performing tasks that normally need human-like thinking. Example: a chatbot that answers questions in written language.

Q2. What is the Internet of Things? Give one example.

The Internet of Things means everyday devices connected to the internet so they can send and receive data. Example: a smart bulb that can be switched on from a phone.

Q3. What is cloud computing?

Cloud computing means using storage and software over the internet instead of only on your own computer, so files and programs can be reached from any device.

Q4. What is the difference between virtual reality and augmented reality?

Virtual reality places the user inside a fully computer-made world, while augmented reality overlays digital information on the real world.

Important long questions

Q1. Explain artificial intelligence and machine learning with everyday examples.

Artificial intelligence is machines doing tasks that need human-like thinking, such as a voice assistant understanding spoken commands or a camera recognising faces. Machine learning is how such systems improve: the computer studies many examples, finds patterns, and gets better at the task. For example, an email program learns to recognise spam by studying many spam and non-spam emails, and its accuracy improves as it sees more examples.

Q2. Explain two emerging technologies and how they help people.

The Internet of Things helps by connecting everyday devices: a fitness band tracks steps and heart rate, and home sensors can warn about smoke or water leakage. Cloud computing helps by storing files online: a student can start homework on a school computer and finish it on a home device, and important files are not lost if one device breaks.

MCQs

1. A smart bulb controlled from a phone is an example of:

a) Robotics b) Blockchain c) Internet of Things d) Virtual reality

2. A computer learning patterns from examples in data is called:

a) Cloud computing b) Machine learning c) Robotics d) 5G

3. Storing and using files over the internet instead of only on your own computer is called:

a) Cloud computing b) Blockchain c) Virtual reality d) Augmented reality

4. Digital directions overlaid on a phone camera view of a real street is an example of:

a) Virtual reality b) Augmented reality c) Robotics d) Internet of Things

Answer key: 1-c, 2-b, 3-a, 4-b

Chapter 8: Ethical, Social, and Legal Concerns in Computer Usage

Summary

Computer security means protecting computer systems and data from damage, theft and unauthorised use. Threats include viruses and other malware (harmful software made to damage or steal), hacking (unauthorised access to a system), phishing (fake messages or websites that trick users into giving away passwords or personal details), and spam (unwanted bulk messages). Protection measures include strong passwords that are long and hard to guess, antivirus software kept up to date, firewalls that control traffic coming into and out of a network, regular backups of important data, and keeping software updated so known weaknesses are fixed.

Beyond security, using computers raises ethical, social and legal concerns. Computer ethics is about using computers honestly and responsibly: respecting other people's privacy and property, not copying software or content illegally (piracy), not spreading false information, and not harming others online. Copyright law protects creators' work, so copying a book, program or song without permission is wrong and may be illegal; software licences state what a user is and is not allowed to do with a program. Socially, behaviour online affects real people: cyberbullying - using digital messages to harass or threaten someone - is harmful, and a digital footprint (the trail of posts, photos and comments a person leaves online) can stay visible for a long time, so thinking before posting matters. Legally, unauthorised access to other people's systems or accounts, stealing or misusing personal data, and distributing others' work without permission can all have legal consequences. Good digital citizenship means using technology in a way that is safe, honest and respectful, protecting one's own personal information, and respecting the rights and privacy of others.

Key definitions and concepts

- **Computer security:** Protecting computer systems and data from unauthorised access, damage and theft.
- **Malware:** Malicious software, such as viruses, worms and spyware, made to harm or exploit a system.

- **Virus:** A type of malware that attaches itself to files or programs and spreads when they are shared.
- **Hacking:** Gaining unauthorised access to a computer system or network.
- **Phishing:** Tricking users into revealing passwords or personal information through fake messages or websites.
- **Firewall:** Software or hardware that monitors and controls network traffic to block unauthorised access.
- **Backup:** A copy of important data kept separately so it can be restored if the original is lost.
- **Copyright:** The legal right of a creator over their original work; copying it without permission is piracy.
- **Piracy:** Copying software, books, music or other protected work without permission.
- **Cyberbullying:** Using digital messages to harass, threaten or embarrass someone.
- **Digital footprint:** The trail of posts, photos, comments and other activity a person leaves online.

Important short questions

Q1. What is malware?

Malware is malicious software designed to damage a computer system, steal information, or give an attacker unauthorised access.

Q2. What is phishing?

Phishing is a trick in which fake emails, messages or websites pretend to be from a trusted source to steal a user's passwords or personal details.

Q3. What is a firewall?

A firewall is a security system that monitors network traffic and blocks unauthorised or harmful connections while allowing legitimate traffic through.

Q4. What is a digital footprint, and why should a student care about it?

A digital footprint is the trail of posts, photos and comments a person leaves online. A student should care because it can stay visible for a long time and may be seen later by teachers, employers or others.

Important long questions

Q1. Explain four ways a user can protect a computer from security threats.

(1) Use strong, unique passwords and keep them private. (2) Install antivirus software and keep it updated. (3) Use a firewall and keep the operating system and programs updated. (4) Avoid opening unknown email attachments or links, and keep regular backups of important files.

Q2. Explain computer ethics with reference to piracy, privacy and online behaviour.

Ethical computer use means respecting the rights of others: piracy - copying software, books or music without permission - takes away the creator's rightful income and breaks copyright law. Respecting privacy means not accessing, sharing or misusing other people's personal information or accounts. Responsible online behaviour also means not spreading false information and not bullying others, because online actions have real effects on real people.

MCQs

1. Which of the following is a type of malware?

a) Firewall b) Virus c) Backup d) Password

2. Fake websites that steal passwords are an example of:

a) Phishing b) Backup c) Copyright d) Browsing

3. Which tool controls network traffic to block unauthorised access?

a) Antivirus b) Firewall c) Spreadsheet d) Browser

4. Copying software without permission is called:

a) Backup b) Phishing c) Piracy d) Hacking

Answer key: 1-b, 2-a, 3-b, 4-c

Chapter 9: Entrepreneurship in Digital Age

Summary

An entrepreneur is a person who starts a business by spotting a need and taking a risk to meet it, and entrepreneurship is the activity of creating and running such a business. In the digital age, many businesses are started and run using the internet and digital tools, which has changed what a new business needs: a small online business can reach customers far away without first renting a shop, and many services can be delivered entirely online.

Common digital business ideas include e-commerce (selling goods through an online shop), online tutoring and courses, app and website services, content creation (educational videos, articles or designs), and freelancing (offering a skill such as writing, design or programming to clients online). The advantages of a digital business include lower starting costs than a physical shop, the ability to reach customers anywhere, and flexible working hours and location. Its challenges include strong competition, technical problems, the need to keep learning new skills, and the need to guard against online fraud.

A new business, digital or not, needs a simple business plan: what problem it solves, who its customers are, what it offers, how it will reach customers, and what it will cost to run versus what it will charge. Digital marketing is how a business reaches customers online: a clear website or shop page, social media pages with honest descriptions and real photos of what is offered, good customer service, and advertising that tells the truth about the product. Trust matters most online, because customers cannot touch the product before buying: honest descriptions, secure payment methods, and careful handling of customers' personal data all build trust. For students, the practical path is to learn useful skills first - such as the web development skills in Chapter 5 and the data skills in Chapter 6 - and to start small, learning from mistakes rather than expecting quick success.

Key definitions and concepts

- **Entrepreneur:** A person who starts a business by spotting a need and taking a risk to meet it.
- **Entrepreneurship:** The activity of creating and running a business.
- **Startup:** A newly started business, often small and built around a new idea.
- **E-commerce:** Buying and selling goods or services over the internet.
- **Freelancing:** Offering a skill or service to clients online, usually project by project, rather than as a permanent employee.
- **Business plan:** A simple plan stating the problem a business solves, its customers, its offer, how it reaches them, and its costs and charges.
- **Digital marketing:** Reaching customers online through a website, shop page, social media and honest advertising.
- **Customer:** A person who buys or uses a business's goods or services.

Important short questions

Q1. Who is an entrepreneur?

An entrepreneur is a person who starts a business by spotting a need and taking a risk to meet it.

Q2. What is e-commerce?

E-commerce is buying and selling goods or services over the internet through an online shop or platform.

Q3. What is freelancing?

Freelancing is offering a skill or service to clients online, usually project by project, rather than working as a permanent employee.

Q4. What is a business plan?

A business plan is a simple plan stating the problem a business solves, who its customers are, what it offers, how it will reach them, and what it will cost versus what it will charge.

Important long questions

Q1. Explain the advantages of a digital business over a physical shop.

A digital business has lower starting costs because it does not need to rent a shop. It can reach customers anywhere, not only in one neighbourhood. Its hours and location are flexible, since much of the work can be done online. It can also be started small and grown gradually, adding products or services as customers increase.

Q2. Explain the main parts of a simple business plan with a small example.

For an online tutoring service, the plan states: the problem (students need help in mathematics after school hours), the customers (9th class students and their parents), the offer (online evening tutoring sessions), how customers are reached (a simple website page and honest social media posts), and the costs and charges (internet and time costs versus a modest fee per session). Writing this down before starting helps the tutor decide whether the idea is workable.

MCQs

1. A person who starts a business by spotting a need is called a/an:

a) Customer b) Entrepreneur c) Freelancer d) Manager

2. Selling goods through an online shop is called:

a) E-commerce b) Freelancing c) Marketing d) Blogging

3. Offering a skill such as design or writing to clients online, project by project, is called:

a) E-commerce b) Freelancing c) Shopping d) Banking

4. A written plan stating a business's problem, customers, offer and costs is called a:

a) Business plan b) Business card c) Invoice d) Advertisement

Answer key: 1-b, 2-c, 3-a, 4-a