

CS-03 : Computer Fundamentals and Emerging Technology

A complete, exam-ready study guide covering every unit of the Saurashtra University syllabus (effective June 2023) — now upgraded with plain "In Simple Words" explanations for absolute beginners, real photographs of hardware, extra worked examples, and a fully-answered exam question bank with page references for quick revision.

5 Units

Real Photos + Diagrams

Beginner-Friendly Explanations

Exam Q&A with Page Numbers

Downloadable PDF

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What is a Computer?

A **computer** is an electronic device that accepts raw data as input, processes it by following a set of instructions (a program), and produces useful output. It can store data, retrieve it later, and perform arithmetic and logical operations at very high speed with accuracy.

IN SIMPLE WORDS A computer is basically a very fast, very obedient calculator-cum-filing-clerk. You give it raw facts ("data"), it follows your exact instructions, and it hands back an answer ("information"). It never gets bored, never makes an arithmetic mistake on its own, and can remember millions of things without forgetting — that's what makes it different from a human doing the same job.

Example: When you type marks of 40 students into Excel and it calculates the class average in a fraction of a second — that is a computer taking *data* (marks), *processing* it (averaging), and giving *information* (the result) as output.

Characteristics of a Computer

Speed

Performs millions of instructions per second (measured in MIPS/GHz).

Accuracy

Produces error-free results if input and instructions are correct.

Diligence

Never gets tired; performs the millionth calculation as accurately as the first.

Storage

Can store huge volumes of data permanently in secondary storage.

Versatility

Can do totally different tasks — gaming, banking, research — using the same hardware.

Automation

Once a program starts, it runs without manual intervention at each step.

Memory trick: Remember the six characteristics with the word **SADSVA** — Speed, Accuracy, Diligence, Storage, Versatility, Automation.

Data Processing Cycle



Data → Process → Information: raw facts become meaningful output after processing.

● **IN SIMPLE WORDS** **Data** is a raw, unorganised fact — like the number "40" on its own means nothing. **Information** is data that has been organised so it means something — "40 out of 40 students passed" tells you something useful. The computer's whole job is turning the first into the second.

🔧 EXTRA DETAIL — FULL DATA PROCESSING CYCLE

In real systems, the simple "Data → Process → Information" picture actually happens in five smaller steps. Knowing all five helps you answer "explain the data processing cycle" questions in full marks:

- **1. Collection** — raw data is gathered from its source (a form, a sensor, a sales counter).
- **2. Preparation** — data is checked, cleaned and arranged in the order the program needs (e.g. sorting names alphabetically).
- **3. Input** — the prepared data is fed into the computer using an input device.
- **4. Processing** — the CPU applies arithmetic and logical operations as instructed by the program.
- **5. Output & Storage** — the result is shown/printed as information, and usually also saved to secondary storage for later use.

Human vs Computer, side by side: a human clerk doing the class-average example might take 10 minutes and occasionally miscount; the computer does it in a fraction of a second and gets the exact same answer every single time, no matter how many times you re-run it. That reliability — not just raw speed — is why computers replaced manual data processing in banks, exam boards and hospitals.

Classification by Data Processed

Type	Processes	Example
Analog Computer	Continuous physical quantities (voltage, temperature, speed)	Speedometer, thermometer-based systems, old weather instruments
Digital Computer	Discrete data in binary (0s and 1s)	Desktop PC, laptop, smartphone
Hybrid Computer	Combination of analog + digital	ICU machines that monitor analog vital signs and display digital readouts

🔗 **IN SIMPLE WORDS** Think of a car's old needle-style speedometer (analog — the needle moves smoothly through every value) versus a digital speed display that jumps between exact numbers like 59, 60, 61 (digital — only fixed steps). A hybrid machine, like a hospital ICU monitor, reads your heartbeat as a smooth analog wave but shows your pulse rate as a clean digital number.

Classification by Processing Capability (Size)

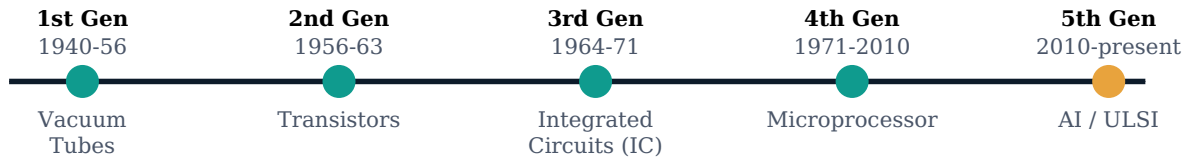
Type	Description	Example
Micro Computer	Smallest, single-user, built around a microprocessor	Desktop PC, laptop, tablet
Mini Computer	Mid-sized, supports multiple users simultaneously	PDP-11, IBM AS/400 (used in mid-size businesses)
Mainframe Computer	Large, powerful, handles bulk data for hundreds of users	IBM Z-series (banks, airlines, railway reservation)
Super Computer	Fastest and most powerful; used for extreme calculations	PARAM, Fugaku (weather forecasting, nuclear simulation, space research)

Easy size ladder (smallest → biggest): Micro → Mini → Mainframe → Super. Your laptop is a Micro; the machine predicting tomorrow's monsoon is a Super Computer.

🔗 EXTRA DETAIL — WHY SIZE ISN'T JUST ABOUT PHYSICAL SIZE

"Micro / Mini / Mainframe / Super" is really a ladder of **processing capability and number of simultaneous users**, not just physical bulk — a modern supercomputer can fit in a few large cabinets, smaller than an old mainframe room. Key exam-worthy distinctions: a **Micro Computer** is built around one microprocessor and normally serves one user at a time (your laptop). A **Mini Computer** can serve a handful to a few hundred users through terminals connected to it. A **Mainframe** is designed from the ground up for bulk, reliable, round-the-clock transaction processing for hundreds/thousands of users (think of railway ticket booking on IRCTC — many people booking at once, no downtime allowed). A **Super Computer** is optimised not for many users but for extremely heavy calculations for a few specialised programs at once (like simulating how a cyclone will move over the next five days), measured in FLOPS (floating point operations per second) rather than everyday speed units.

History and Generations of Computers



Timeline of computer generations from vacuum tubes to Artificial Intelligence.

Generation	Technology Used	Key Traits
1st (1940–56)	Vacuum Tubes	Huge size, generated heat, used machine language, e.g. ENIAC, UNIVAC
2nd (1956–63)	Transistors	Smaller, faster, less heat, used assembly language
3rd (1964–71)	Integrated Circuits (IC)	Multiple transistors on a chip; keyboards & monitors introduced
4th (1971–2010)	Microprocessors (VLSI)	Personal computers born; GUI, internet, mouse introduced
5th (2010–present)	ULSI & AI	Artificial Intelligence, voice recognition, parallel processing

 Photo reference

(view online HTML edition for the real photograph)

1st Gen — vacuum tubes (ENIAC)

Photo: Wikimedia Commons

 Photo reference

(view online HTML edition for the real photograph)

2nd Gen — transistors

Photo: Wikimedia Commons

 Photo reference

(view online HTML edition for the real photograph)

3rd Gen — integrated circuit (IC chip)

Photo: Wikimedia Commons

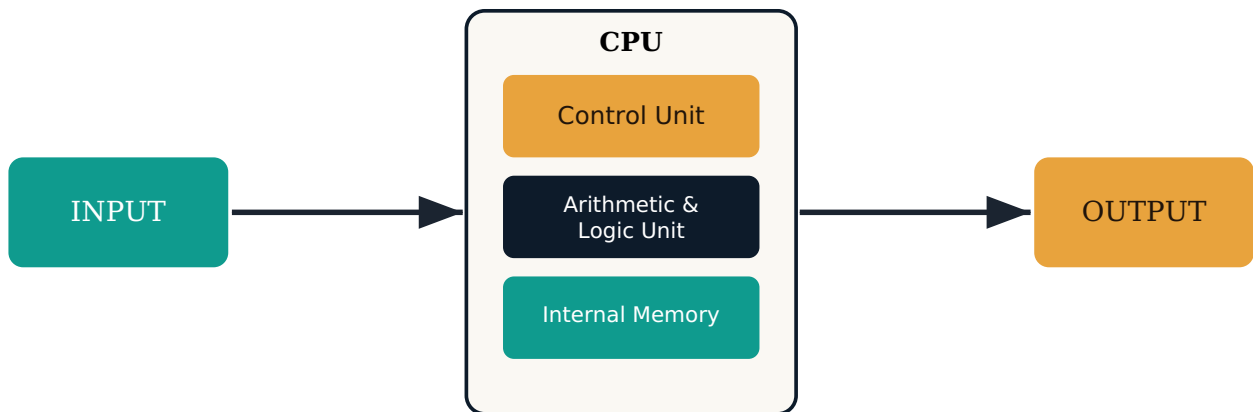
● **IN SIMPLE WORDS** Each generation simply means "the same job, done with smaller and cooler parts." A vacuum tube is roughly the size of a light bulb; a transistor is the size of a rice grain; an Integrated Circuit (IC) packs thousands of transistors onto a chip the size of a fingernail; and today's microprocessor packs *billions* of transistors into that same fingernail-sized space. Smaller parts = faster, cheaper, cooler-running computers — which is why your phone is more powerful than a room-sized 1950s computer.

🔗 **EXTRA DETAIL — WHAT CHANGED AT EACH GENERATION BOUNDARY**

- **1st → 2nd:** Vacuum tubes broke often and used huge power; transistors solved both problems, so machines shrank from room-size toward cupboard-size.
- **2nd → 3rd:** Instead of wiring thousands of loose transistors by hand, engineers learned to print many transistors onto one small chip (the Integrated Circuit) — cheaper, faster, more reliable.
- **3rd → 4th:** All the components of a CPU were squeezed onto a *single* chip called a microprocessor (e.g. Intel 4004 in 1971) — this is the moment "personal computers" became possible for ordinary homes and offices.
- **4th → 5th:** Chips became so densely packed (ULSI — Ultra Large Scale Integration) that computers gained enough power to run Artificial Intelligence, natural-language voice assistants, and massively parallel processing.

Exam tip: if asked to "give one example of each generation", the safest answers are: 1st — ENIAC/UNIVAC, 2nd — IBM 1401, 3rd — IBM 360, 4th — IBM PC/Apple Macintosh, 5th — AI-based systems such as IBM Watson.

Simple Model of a Computer



Input → CPU (Control Unit + ALU + Memory) → Output — the basic computer model.

- **Input Devices** — feed data/instructions into the computer (keyboard, mouse).
- **CPU** — the "brain"; contains the Control Unit and ALU.
- **Arithmetic & Logic Unit (ALU)** — performs calculations (+, −, ×, ÷) and logical comparisons (>, <, =).
- **Control Unit (CU)** — directs and coordinates all operations; fetches, decodes, executes instructions.
- **Internal Memory** — temporary high-speed storage (RAM) used while processing.
- **Output Devices** — display or print the processed result (monitor, printer).
- **Secondary Storage Devices** — store data permanently even when power is off (hard disk, SSD, pen drive).

🍳 **IN SIMPLE WORDS** Picture a kitchen: **Input** is the raw vegetables coming in, the **CPU** is the chef (Control Unit = chef's brain deciding order of steps, ALU = the chef's hands actually cutting/mixing), **Memory** is the counter-space the chef works on right now, and **Output** is the finished dish served to you. The **fridge** (secondary storage) keeps ingredients safe even when the kitchen is closed for the night — that's the difference from the counter (RAM), which is cleared once the power/work session ends.

Internal / External Parts Used with the Computer Cabinet

Motherboard

The **motherboard** is the main circuit board that connects the CPU, RAM, storage, and every other component so they can communicate with each other — think of it as the "nervous system" of the cabinet.

📷 Photo reference

(view online HTML edition for the real photograph)

A real desktop motherboard — every component in the cabinet plugs into it.

Photo: Wikimedia Commons

Types of Processors

Processors evolved from single-core to multi-core designs for more parallel work: **Dual Core** **Core 2 Duo**

Intel i3 **Intel i5** **Intel i7 / i9** . More cores = more tasks handled simultaneously.

● **IN SIMPLE WORDS** A "core" is like one worker inside the CPU. A single-core chip has one worker doing everything one task at a time; a quad-core chip has four workers who can each handle a different task at the same time — so your computer can play music, run a browser, and scan for viruses all at once without slowing to a crawl.

Memory Structure and Types of Memory

RAM — Random Access Memory (Volatile)

- **SRAM** — Static RAM, faster, used in CPU cache
- **DRAM** — Dynamic RAM, needs refreshing, used as main memory
- **SO-DIMM** — Small Outline, used in laptops
- **DDR (DDR3/DDR4/DDR5)** — Double Data Rate, current standard RAM

ROM — Read Only Memory (Non-volatile)

- **ROM** — data written permanently at manufacture
- **PROM** — Programmable ROM, written once by user
- **EPROM** — Erasable PROM, erased using UV light
- **EEPROM** — Electrically Erasable PROM, erased/rewritten electrically (used in BIOS)

Remember it as: RAM = temporary "workspace" (lost on power-off), ROM = permanent "instructions" (retained on power-off).

● **IN SIMPLE WORDS** RAM is like a whiteboard: you scribble on it while working, and it gets wiped clean the moment the power goes off. ROM is like a page printed in a book: it was written once (usually by the manufacturer) and stays exactly the same whether the computer is on or off — it's what tells the computer how to "wake up" (boot) each time you switch it on.

🔗 EXTRA DETAIL — THE FULL MEMORY HIERARCHY

Exam papers sometimes ask you to arrange memory "from fastest/smallest to slowest/largest". The correct order, with everyday comparison, is:

- **Registers** (inside the CPU) — fastest, tiniest, holds the value being worked on *right now*. Like the item literally in your hand.
- **Cache (SRAM)** — very fast, small, sits between CPU and RAM to reduce waiting. Like a small drawer next to your desk.
- **Main Memory / RAM (DRAM)** — fast, moderate size, holds the program and data currently in use. Like your full desk.
- **Secondary Storage** (HDD/SSD) — slower, huge capacity, permanent. Like a cupboard in the next room.

General rule: the closer memory sits to the CPU, the faster and more expensive (per byte) it is, and the smaller its capacity — that trade-off is why computers use a whole hierarchy instead of one giant fast memory.

Slots, Sockets, Cables & Ports

Category	Examples	Purpose
Slots	ISA Slot, PCI Slot, Memory Slot (DIMM)	Hold expansion cards and RAM modules on the motherboard
Sockets	CPU Socket	Houses and connects the processor to the motherboard
Cables	Serial Cable, Parallel Cable, USB Cable	Carry data between devices
Ports	USB, Serial, Parallel, PS/2, HDMI	External connection points for peripherals

Power & Add-On Cards

- **UPS (Uninterruptible Power Supply)** — provides temporary battery backup power during outages so work is not lost.
- **Graphics Card** — renders images/video (essential for gaming, video editing).
- **Network Card (NIC)** — connects the computer to a wired/wireless network.
- **Sound Card** — processes and outputs audio signals.

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Types of Input Devices

 Photo reference

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Keyboard and mouse — the two input devices almost everyone uses first.

Photo: Wikimedia Commons

Device	Use
Keyboard	Typing text and commands
Mouse / Trackball / Glide-Pad	Pointing and clicking to navigate the screen
Game Devices (Joystick, etc.)	Controlling movement/actions in games and simulators
Light Pen	Drawing/selecting directly on a screen using a light-sensitive stylus
Touch Screen	Direct input by finger/stylus touch (smartphones, ATMs, kiosks)
Digitizer / Graphic Tablet	Converts hand-drawn images/graphics into digital form
Mic	Sound/voice input
Camera	Photo and video input
POS Terminal & Scanners	Reading product/price data at checkout counters
MIDI Keyboard	Musical Instrument Digital Interface input for music production
Wireless Devices	Keyboards/mice that connect via Bluetooth/RF instead of a cable

 **IN SIMPLE WORDS** Any device whose whole job is to get information *into* the computer is an input device — that's the simplest test. If you're the one giving the computer something (a keystroke, a click, your voice, a photo), it's input.

Types of Scanners

OCR — Optical Character Recognition

Converts printed/handwritten text images into editable text.

OMR — Optical Mark Recognition

Detects marks on a sheet — used for checking OMR answer sheets.

MICR — Magnetic Ink Character Recognition

Reads magnetic ink characters — used on bank cheques.

OBR — Optical Bar Recognition

Reads barcodes on retail products.

Easy way to remember: OCR reads *letters*, OMR reads *filled bubbles* (like your exam OMR sheet), MICR reads the *funny numbers at the bottom of a cheque*, and OBR reads *barcodes* at a shop counter.

🔗 EXTRA DETAIL — DIRECT VS INDIRECT INPUT DEVICES

Input devices can also be grouped by **how** they capture data — a distinction examiners like to test:

- **Keyboard-type (character) devices** — key presses become characters directly: keyboard, MICR reader.
- **Pointing devices** — control an on-screen cursor/position: mouse, trackball, joystick, touch screen, light pen.
- **Scanning / image-capture devices** — read an existing image or mark and convert it to digital data: OCR, OMR, barcode scanner, digitizer, camera.
- **Direct data-entry devices** — take data straight from its physical source without a human retyping it, reducing errors: POS terminal, MICR (bank cheques), OMR (answer sheets). These are valued in banking/exams precisely because they remove typing mistakes.

Data Storage

Types of Magnetic Storage Devices

Floppy Disk, Hard Disk (SATA, SSD), Magnetic Tape, and Magnetic Disks all store data using magnetized regions on a surface.

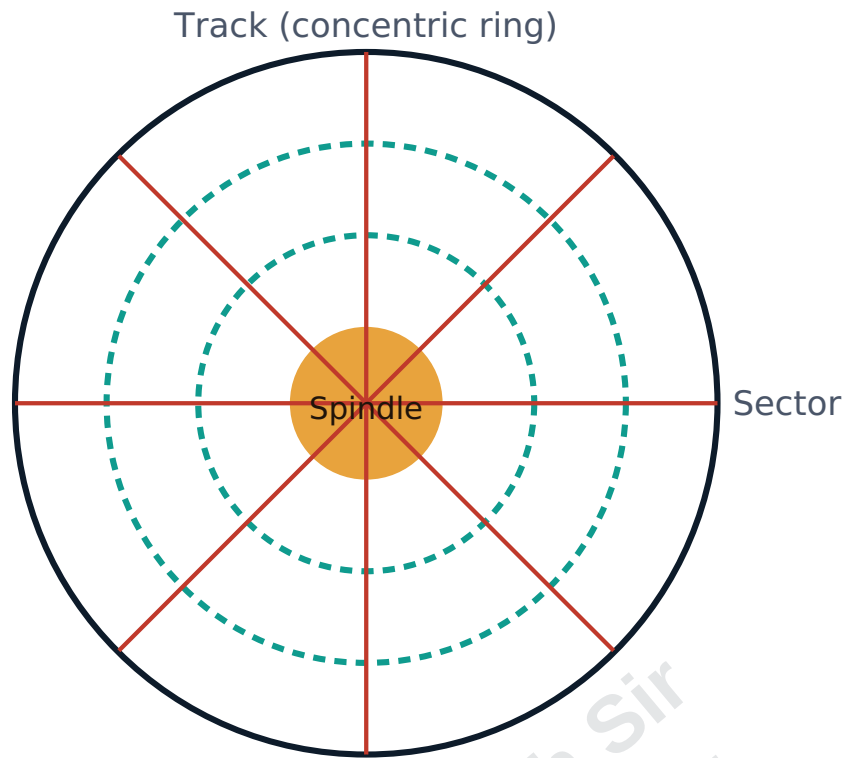
🖼️ Photo reference

(view online HTML edition for the real photograph)

Inside a hard disk drive — the shiny platter is where data is magnetically stored, and the arm reads/writes it.

Photo: Wikimedia Commons

Storage Mechanism — How Data Sits on a Disk



Tracks (concentric rings), Sectors (pie slices) and Clusters (groups of sectors) form the addressable storage grid; a Cylinder is the same track across all stacked disk platters.

Term	Meaning
Track	A single concentric circular ring on the disk surface
Sector	A pie-shaped division of a track — the smallest storage unit read at once
Cluster	A group of sectors treated as one storage unit by the OS
Cylinder	The same track number across all platters, accessed together

● **IN SIMPLE WORDS** Imagine a vinyl record: each ring you see is a **track**. Now slice the whole record like a pizza — each pizza slice crossing a track is a **sector**. A **cluster** is just a small bunch of sectors the operating system treats as one unit, the way a courier bundles small packets into one box. If you stack several such "records" (platters) on the same spindle, the matching track on every platter, taken together, is called a **cylinder**.

Reading/Writing Speed Terms

Term	Meaning
Seek Time	Time taken by the read/write head to move to the correct track
Rotational Delay (Latency)	Time taken for the disk to rotate so the required sector is under the head
Access Time	Seek Time + Rotational Delay (total time to locate data)
Response Time	Total time from request to the first byte of data being delivered

Other Storage Devices

- USB Pen Drive, CD, DVD, Blu-Ray Disk — portable optical/flash storage

- Flash Memory — solid-state, no moving parts (used in SSDs, memory cards)
- Cloud Storage — data stored on remote servers accessed via the internet, e.g. Google Drive, OneDrive

Why SSDs feel faster: A hard disk has to physically move an arm and spin a platter (seek time + rotational delay), like a record player finding a song. An SSD has no moving parts at all — it's pure electronics, so it can jump straight to the data almost instantly.

🔗 **EXTRA DETAIL — PRIMARY VS SECONDARY STORAGE, AND STORAGE UNITS RECAP**

Primary storage (RAM, cache, registers) is fast, expensive per byte, and volatile (data lost on power-off) — the CPU works with it directly. **Secondary storage** (hard disk, SSD, pen drive, CD/DVD) is slower, cheap per byte, and non-volatile — it exists purely to keep data safe long-term. A computer needs both: primary storage for speed while working, secondary storage for permanence afterward.

Storage size ladder (each step is $1024\times$ the one before it): Byte → Kilobyte (KB) → Megabyte (MB) → Gigabyte (GB) → Terabyte (TB) → Petabyte (PB). A single typed page of text is roughly 2 KB; an average song is a few MB; a modern laptop hard disk is measured in hundreds of GB to a few TB.

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Display Units

Type	Description
CRT (Cathode Ray Tube)	Older, bulky display using an electron beam on phosphor screen
LCD (Liquid Crystal Display)	Flat panel using liquid crystals; lighter, energy efficient
LED (Light Emitting Diode)	LCD backlit by LEDs; better brightness and contrast
Plasma Display	Uses charged gas cells; used in large-screen TVs

● **IN SIMPLE WORDS** An LED monitor is really an LCD monitor — the only difference is what lights it up from behind. That's why "LCD vs LED" confuses people: LED is simply a newer, brighter, thinner way of lighting up the same liquid-crystal panel technology.

Types of Printers

Impact Printers

Print by physically striking a ribbon against paper (like a typewriter). Noisy but cheap; can print carbon copies.

Examples: Dot Matrix Printer, Daisy Wheel Printer

Non-Impact Printers

Print without physically striking the paper — quieter and higher quality.

Examples: Inkjet Printer, Laser Printer

Plotters use pens or ink jets to draw precise line-based graphics — commonly used for engineering drawings and maps.

Quick test to remember Impact vs Non-Impact: Ask "does something physically hit the paper?" A dot-matrix printer's pins hit a ribbon onto paper (Impact — and it's loud). A laser printer just fuses toner onto paper with heat, no striking (Non-Impact — and it's quiet).

✎ EXTRA DETAIL — HOW A LASER PRINTER ACTUALLY PRINTS

A laser printer works in four quick stages, which is a favourite "explain briefly" exam question: **(1) Charging** — a drum inside the printer is given a static electric charge. **(2) Exposing** — a laser beam draws the page image onto the drum, changing the charge only where text/graphics should appear. **(3) Developing** — fine toner powder sticks only to the charged (image) areas of the drum. **(4) Fusing** — the drum rolls the toner onto paper, and a heated roller fuses/melts it permanently onto the page. Because everything is electrostatic and heat-based rather than mechanical striking, laser printers are fast, quiet, and produce sharp output — which is why offices prefer them over dot-matrix for everyday printing.

Other Output Devices

FAX

Transmits scanned document images over telephone lines.

OLED

Organic LED — self-lit thin displays, no backlight needed.

Headphone

Personal audio output device.

SGD

Speech Generating Device — converts text/symbols to speech for assistive communication.

COM

Computer Output Microfilm — records data as tiny images on film for archival.

Google Glass

Wearable optical head-mounted display device.

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Binary Building Blocks

IN SIMPLE WORDS A computer's electronics only understand two states — "switch on" and "switch off." We call these two states 1 and 0. Everything a computer ever stores — this sentence, a photo, a song — is, deep down, just a very long string of 1s and 0s. All the terms below are simply names for different-sized groups of these 1s and 0s.

Term	Meaning
Bit	A single binary digit — 0 or 1 (smallest unit of data)
Nibble	Group of 4 bits
Byte	Group of 8 bits — represents one character
Carry Bit	Generated when addition of two bits exceeds the max value (produces a carry to the next column)
Parity Bit	Extra bit added to detect transmission errors
Sign Bit	Leftmost bit used to indicate positive (0) or negative (1) numbers

Storage Size Units

1 KB = 1024 Bytes

1 MB = 1024 KB

1 GB = 1024 MB

1 TB = 1024 GB

Types of Number Systems

System	Base	Digits Used
Binary	2	0, 1
Octal	8	0-7
Decimal	10	0-9
Hexadecimal	16	0-9, A-F

IN SIMPLE WORDS "Base" just means "how many different digits are available before you have to carry over to the next column." We normally count in base 10 (decimal) because we have 10 fingers — after 9 we run out of single digits and roll over to "10". Binary runs out after just 1 digit (0,1), so it rolls over very fast; hexadecimal doesn't run out until 15 (0-9, then A-F stand in for 10-15), so it rolls over slowly. Computers use binary because it maps perfectly to "switch on / switch off."

Number System Conversions (Worked Examples)

Decimal → Binary: Convert 25_{10} to binary — divide by 2 repeatedly and read remainders bottom-to-top.

```

25 ÷ 2 = 12  rem 1
12 ÷ 2 = 6   rem 0
6  ÷ 2 = 3   rem 0

```



```
3 ÷ 2 = 1   rem 1
1 ÷ 2 = 0   rem 1
Answer (read bottom→top): 110012
```

Binary → Decimal: Convert 1101₂ to decimal — multiply each digit by its power of 2.

$$\begin{aligned} 1101_2 &= 1 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0 \\ &= 8 + 4 + 0 + 1 = 13_{10} \end{aligned}$$

Decimal → Octal: Convert 50₁₀ to octal — divide by 8 repeatedly.

```
50 ÷ 8 = 6   rem 2
6 ÷ 8 = 0   rem 6
Answer: 628
```

Octal → Decimal (extra example): Convert 62₈ back to decimal — multiply each digit by its power of 8, to prove the conversion above.

$$\begin{aligned} 62_8 &= 6 \times 8^1 + 2 \times 8^0 \\ &= 48 + 2 = 50_{10} \quad \checkmark \text{ matches the number we started with} \end{aligned}$$

Decimal → Hexadecimal: Convert 255₁₀ to hex — divide by 16 repeatedly.

```
255 ÷ 16 = 15   rem 15 (F)
15 ÷ 16 = 0     rem 15 (F)
Answer: FF16
```

Hexadecimal → Decimal (extra example): Convert 1A₁₆ to decimal.

$$\begin{aligned} 1A_{16} &= 1 \times 16^1 + 10 \times 16^0 \quad (A = 10) \\ &= 16 + 10 = 26_{10} \end{aligned}$$

Binary ↔ Octal / Hex shortcut: Group binary digits in 3s for octal, in 4s for hex.

```
Binary: 1 1010 1101 → group by 4 → 0001 1010 1101 → Hex: 1 A D → 1AD16
Binary: 11 010 101 → group by 3 → 011 010 101 → Octal: 3 2 5 → 3258
```

Quick trick: memorise Binary-to-Decimal place values 128, 64, 32, 16, 8, 4, 2, 1 for an 8-bit number — it makes every conversion direction fast.

✎ EXTRA DETAIL — WORKED EXAMPLE: 35₁₀ TO BINARY, OCTAL AND HEX (COMMON EXAM QUESTION)

This exact style of question ("Convert 35 to Binary, Octal and Hexadecimal") appears often, so here is a full worked solution:

Binary: $35 \div 2 = 17$ rem 1
 $17 \div 2 = 8$ rem 1
 $8 \div 2 = 4$ rem 0
 $4 \div 2 = 2$ rem 0
 $2 \div 2 = 1$ rem 0
 $1 \div 2 = 0$ rem 1
Answer (bottom→top): 100011_2

Octal: $35 \div 8 = 4$ rem 3
 $4 \div 8 = 0$ rem 4
Answer: 43_8

Hex: $35 \div 16 = 2$ rem 3
 $2 \div 16 = 0$ rem 2
Answer: 23_{16}

Check: $100011_2 = 32+2+1 = 35$ ✓. $43_8 = 4 \times 8 + 3 = 35$ ✓. $23_{16} = 2 \times 16 + 3 = 35$ ✓ — always verify your final answer by converting back to decimal in the exam, it catches silly mistakes.

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Binary Arithmetic

Binary Addition: Rules: $0+0=0$, $1+0=1$, $1+1=10$ (carry 1), $1+1+1=11$ (carry 1)

```
  1011   (11)
+ 1101   (13)
-----
 11000   (24)
```

Binary Subtraction using 1's Complement: Flip every bit of the number being subtracted, then add.

```
1010 - 0011
1's complement of 0011 = 1100
1010 + 1100 = 1 0110 → add the extra carry back → 0111 = 7 (10-3=7 ✓)
```

Binary Subtraction using 2's Complement: 1's complement + 1, then add.

```
1010 - 0011
2's complement of 0011 = 1100 + 1 = 1101
1010 + 1101 = 1 0111 → discard the leading carry → 0111 = 7 ✓
```

Binary Multiplication: Same rules as decimal long multiplication.

```
  101   (5)
×  11   (3)
-----
  101
 101
-----
 1111   (15)
```

Binary Division: Works like long division — repeated subtraction of the divisor. e.g. $1100_2 (12) \div 100_2 (4) = 11_2 (3)$.

● **IN SIMPLE WORDS** 1's and 2's complement are just tricks so a computer can "subtract" using only its addition circuit. Flipping every bit ($0 \rightarrow 1$, $1 \rightarrow 0$) is the 1's complement — like a mirror image. Adding 1 more to that mirror image gives the 2's complement, which is the trick real computers actually use because it avoids an extra correction step.

Types of Codes

Code	Full Form	Use
ASCII	American Standard Code for Information Interchange	7/8-bit code for English characters — e.g. 'A' = 65 = 01000001
BCD	Binary Coded Decimal	Each decimal digit stored as a separate 4-bit binary group
EBCDIC	Extended Binary Coded Decimal Interchange Code	8-bit code used mainly on IBM mainframes
Unicode	Universal Code	16-bit (or more) code supporting characters of virtually every world language

🌐 **IN SIMPLE WORDS** ASCII can only represent English letters, digits and symbols (256 possibilities at most) — it has no way to store "অুজসানী" or "中文". Unicode was invented precisely to fix that, using more bits so it can represent virtually every character in every language on Earth, including emojis 😊.

Parity Check

A **parity bit** is added to a byte to detect errors during data transmission.

Even Parity

Total number of 1-bits (including the parity bit) must be even.

Odd Parity

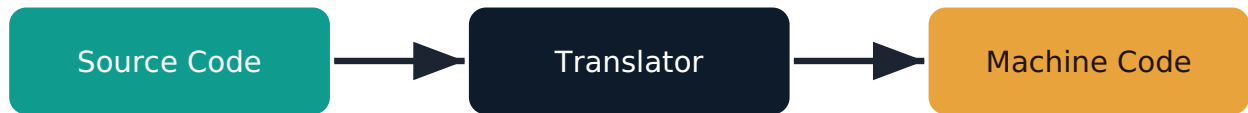
Total number of 1-bits (including the parity bit) must be odd.

Example: Data = 1010001 (three 1-bits, odd). For **even parity**, add parity bit = 1 → total four 1-bits (even) ✓. For **odd parity**, add parity bit = 0 → total stays three 1-bits (odd) ✓.

🔧 EXTRA DETAIL — LIMITS OF PARITY CHECKING

Parity checking is simple but not perfect: it can reliably catch an **odd number** of bit errors (1, 3, 5...), but if exactly **two** bits flip during transmission, the total count of 1-bits returns to what it should be, and the error slips through undetected. This is why parity is only used for basic error *detection* (it tells you something went wrong) and not error *correction* (it cannot tell you which bit was wrong or fix it) — more advanced techniques such as checksums and CRC (Cyclic Redundancy Check) are used where stronger protection is needed, e.g. in networks and storage devices.

Translators



Translator	How it works
Assembler	Converts Assembly language directly into machine code
Compiler	Converts the entire high-level program into machine code at once, then executes
Interpreter	Converts and executes a high-level program line-by-line

● **IN SIMPLE WORDS** A Compiler is like translating a whole book into another language before handing it to the reader — it takes longer up front, but the final book reads fast. An Interpreter is like a live interpreter at a meeting, translating sentence-by-sentence as the speaker talks — it starts instantly but is slower overall, and it stops the moment it hits a sentence it can't translate.

Types of Languages

- **Machine Level Language** — pure binary (0s/1s); directly understood by hardware, fastest but hardest to write.
- **Assembly Level Language** — uses mnemonics (ADD, SUB, MOV) instead of raw binary.
- **High Level Language** — human-readable, English-like syntax:
 - **3GL** — procedural languages, e.g. C, Pascal
 - **4GL** — closer to natural language, e.g. SQL
 - **5GL** — problem-solving/AI-based, e.g. Prolog

✎ EXTRA DETAIL — WHY NOT JUST WRITE EVERYTHING IN MACHINE LANGUAGE?

Each step up the language ladder trades a little speed for a lot of ease: **Machine language** runs fastest since the CPU needs no translation at all, but writing raw 0s and 1s is extremely slow and error-prone for humans. **Assembly language** replaces binary opcodes with short mnemonics (ADD, SUB, MOV, JMP) that are easier to remember, but still needs an Assembler to convert it to machine code, and is still tied to one specific processor design. **High-level languages** (C, Python, SQL...) read almost like English, are portable across different machines, and let a programmer build large software quickly — but they need a Compiler or Interpreter, and the generated machine code is sometimes slightly less optimal than hand-written assembly. This is exactly why operating system kernels are often written partly in Assembly (for speed at the hardware level) and partly in a high-level language like C (for manageability).

Types of Operating Systems

Type	Description
Batch Operating System	Groups similar jobs together and processes them without user interaction during execution
Multi Processing Operating System	Uses two or more CPUs within a single system to execute processes simultaneously
Time Sharing Operating System	Allocates small time slices to multiple users so each feels they have full attention of the CPU
Online and Real Time Operating System	Processes data instantly as it arrives, with guaranteed response within strict time limits (e.g. flight control systems)

● **IN SIMPLE WORDS** Think of a bank: a **Batch OS** is like collecting a whole day's cheques and clearing them together at night. A **Time Sharing OS** is like a single bank teller quickly serving many customers in turn, so fast that each customer feels they have the teller's full attention. A **Real Time OS** is like an airbag sensor — it simply cannot be late, or the consequence is serious.

Uses & Applications of Software Packages

Word Processing

MS Word, Google Docs — creating/editing documents

Spreadsheet

MS Excel, Google Sheets — calculations, tables

Graphical

Photoshop, CorelDRAW — image editing/design

Database

MS Access, MySQL — storing/managing structured data

Presentation

PowerPoint, Google Slides — slideshows

Animation/Video/Sound

Premiere Pro, Audacity — media production

Communication Methods & Devices

GIS

Geographic Information System — captures and analyses location-based data.

GPS

Global Positioning System — satellite-based navigation/location tracking.

CDMA

Code Division Multiple Access — mobile communication technology.

GSM

Global System for Mobile communication — widely used cellular standard.

Communication Devices: Cell Phones, Modem (modulator-demodulator), Infrared, Bluetooth, Wi-Fi, Li-Fi (light-based wireless data), SLM (Spatial Light Modulator).

✎ EXTRA DETAIL — HOW A MODEM GETS YOUR DATA ONTO A PHONE LINE

A **Modem** (short for *Modulator-Demodulator*) exists because computers store data digitally (0s and 1s) but ordinary telephone lines were built to carry analog (continuously varying) sound signals. At the sending end, the modem **modulates** — converts the computer's digital data into an analog signal suitable for the line. At the receiving end, another modem **demodulates** — converts that analog signal back into digital data the receiving computer can understand. This same modulate/demodulate idea also underlies GSM and CDMA — both eventually turn your phone's digital data into radio waves and back again.

Computer Virus

A **computer virus** is a malicious self-replicating program that attaches itself to files/programs and spreads from one computer to another, often corrupting or destroying data.

🔍 **IN SIMPLE WORDS** Just like a biological virus needs a living cell to copy itself, a computer virus needs a host file or program to attach to and spread — it can't run on its own from nowhere. That's the one-line difference between a virus and a worm: a worm doesn't need a host file, it spreads by itself across a network.

Types of Virus

Type	Behaviour
Boot Sector Virus	Infects the master boot record; activates when the system starts
File Infector Virus	Attaches to executable files and spreads when the file runs
Macro Virus	Embedded inside documents (e.g. Word/Excel macros)
Worm	Self-replicates and spreads across networks without user action
Trojan Horse	Disguised as legitimate software but carries hidden malicious code
Ransomware	Encrypts victim's data and demands payment for the decryption key

Protection from Virus

- Install and regularly update trusted antivirus software
- Avoid downloading attachments/software from unknown sources
- Keep the operating system and applications patched/updated
- Take regular backups of important data
- Use a firewall and scan external drives before opening

🔍 EXTRA DETAIL — VIRUS VS WORM VS TROJAN VS RANSOMWARE, AT A GLANCE

These four terms are frequently confused in exams, so lock in this one-line test for each: a **Virus** needs a host file and needs a human action (like opening an infected file) to spread. A **Worm** needs no host file and no human action — it copies itself across a network automatically. A **Trojan Horse** does not self-replicate at all; it simply tricks the user into installing it by pretending to be useful software, then quietly does damage or opens a backdoor. **Ransomware** is defined by its goal rather than its spreading method — whatever way it gets in, its job is to lock/encrypt your files and demand money to unlock them.

Cloud Computing

Cloud Computing means delivering computing services — servers, storage, databases, software — over the internet ("the cloud") instead of owning physical hardware.

🔍 **IN SIMPLE WORDS** Instead of buying and maintaining your own server room, you "rent" computing power from a company like Amazon or Google over the internet — the same way you rent an apartment instead of building a house. You pay only for what you use, and someone else handles the maintenance.

Characteristics

On-demand self-service, broad network access, resource pooling, rapid elasticity, and measured

(pay-as-you-go) service.

Service Models

SaaS — Software as a Service (Gmail, Netflix, MS 365)

PaaS — Platform as a Service (Google App Engine, Azure App Service)

IaaS — Infrastructure as a Service (AWS EC2, Google Compute Engine)

The three main cloud service models, from ready-to-use software down to raw infrastructure.

● **IN SIMPLE WORDS** Think of a pizza analogy: **IaaS** is buying the raw ingredients and using your own kitchen (you manage almost everything). **PaaS** is ordering a pizza-making kit where the dough and oven setup is done for you, you just add toppings (you manage your app, provider manages the platform). **SaaS** is ordering a finished pizza delivered to your door (you just use the software, e.g. Gmail — nothing to install or manage).

Architecture

Broadly split into a **Front End** (the client device/browser used to access cloud services) and a **Back End** (the servers, storage, and databases that actually store/process the data), connected over the internet.

Security & Privacy

Key concerns include data encryption (in transit and at rest), user authentication/access control, regular security audits, and compliance with data-protection regulations, since data resides on a third-party provider's infrastructure.

🔗 EXTRA DETAIL — DEPLOYMENT MODELS OF CLOUD COMPUTING

Besides the three service models (IaaS/PaaS/SaaS), cloud computing is also classified by **who can use it** — another common exam angle: a **Public Cloud** is owned by a third-party provider and shared across many customers over the open internet (e.g. AWS, Azure, Google Cloud) — cheapest, but least control. A **Private Cloud** is dedicated to a single organisation, either on their own premises or hosted privately — more control and security, at higher cost. A **Hybrid Cloud** combines both, letting an organisation keep sensitive data on a private cloud while using the public cloud for less sensitive, high-demand workloads — giving flexibility without giving up all control.



Important Terms & Acronyms

Quick-reference glossary for exam revision

ATM

Automated Teller Machine — self-service banking terminal.

Backup / Restore

Copying data for safekeeping / bringing it back after loss.

Hard Copy / Soft Copy

Printed physical output vs. on-screen digital output.

Bus / Data Bus

Set of electrical paths that carry data between components.

Buffer / Spooling

Temporary storage area that manages the speed mismatch between devices.

Cursor / Pointer / Icon

On-screen marker, mouse indicator, small graphic representing a file/program.

E-Mail / Attachment

Electronic mail and the file sent along with it.

CLI / GUI

Command Line Interface (text) vs. Graphical User Interface (visual/icons).

Compiler & its types

Translator converting full high-level code to machine code (single-pass, multi-pass, cross-compiler).

Drive / Directory / File / Path

Storage unit, folder, individual data unit, and the address locating it.

Menu / Popup Menu / Toolbar

List of options; a menu that appears on right-click; a bar of quick-access icons.

Shutdown / Reboot / Restart

Powering off, restarting after full shutdown, or immediate restart.

Syntax / Wild Card Characters

Grammar rules of a language; symbols (*, ?) representing unknown characters in search.

Optical Fiber

Thin glass/plastic strand transmitting data as light pulses at very high speed.

Net Meeting

Real-time online conferencing between multiple participants.

Printing Speed

CPS/CPM (characters), LPM (lines), DPI (dots per inch), PPM (pages) per minute.

Peripherals

Any external device attached to a computer (printer, scanner, keyboard).



Important Exam Questions — with Model Answers

Frequently asked university-pattern questions, organised by unit, each with a page reference back to the full explanation

How to use this section: Each question already has a complete model answer you can write in the exam as-is. The small dark badge (e.g. **p. 3**) tells you the PDF page where that topic is explained in full detail with diagrams — open the answer, then flip to that page if you want the longer explanation or a worked example.

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Unit 1 — Introduction to Computers p. 2

▼ Long Define a computer. Explain its characteristics with examples. p. 2

ANSWER: A computer is an electronic device that accepts data as input, processes it according to a stored set of instructions (a program), and produces information as output; it can also store data for later use. Its six main characteristics are: **Speed** (executes millions of instructions per second — e.g. calculating the average of 40 students' marks instantly), **Accuracy** (gives error-free results if the input and program are correct), **Diligence** (performs the millionth calculation exactly as accurately as the first, without fatigue), **Storage** (can permanently hold huge volumes of data in secondary storage such as a hard disk), **Versatility** (the same hardware can run a game, a spreadsheet, or a banking application), and **Automation** (once started, a program runs through to completion without step-by-step manual intervention).

▼ Long Explain the generations of computers with their technologies. p. 4

ANSWER: Computers have evolved through five generations. **1st Generation (1940–56)** used bulky, heat-generating vacuum tubes and machine language, e.g. ENIAC and UNIVAC. **2nd Generation (1956–63)** replaced tubes with smaller, cooler transistors and introduced assembly language. **3rd Generation (1964–71)** packed many transistors onto Integrated Circuits (ICs), and keyboards/monitors became standard. **4th Generation (1971–2010)** used microprocessors (VLSI chips), giving birth to personal computers, GUIs, the mouse and the internet. **5th Generation (2010–present)** uses ULSI chips and focuses on Artificial Intelligence, voice recognition, and parallel processing. Each step made computers smaller, faster, cheaper and more power-efficient.

▼ Short Differentiate between RAM and ROM. p. 6

ANSWER: RAM (Random Access Memory) is volatile — it loses its content the moment power is switched off — and it is both readable and writable, used as the computer's temporary working memory (types include SRAM, DRAM, DDR). ROM (Read Only Memory) is non-volatile — it retains data even without power — and is mostly read-only, used to permanently store instructions such as the BIOS (types include PROM, EPROM, EEPROM).

▼ Short Classify computers based on data processed. p. 3

ANSWER: Based on the type of data processed, computers are of three kinds: **Analog** computers process continuous physical quantities like voltage, temperature or speed (e.g. a speedometer); **Digital** computers process discrete binary data — 0s and 1s (e.g. a desktop PC or smartphone); and **Hybrid** computers combine both — for example, an ICU machine that reads analog vital signs but displays a digital readout.

▼ Short What is a motherboard? What does it connect? p. 5

ANSWER: The motherboard is the main printed circuit board inside the computer cabinet. It physically connects and allows communication between the CPU, RAM, storage devices, expansion cards (graphics, sound, network) and all ports, acting as the central nervous system of the computer.

Unit 2 — Input Devices & Data Storage p. 7

▼ Long Explain various input devices with their uses. p. 7

ANSWER: Input devices feed data and instructions into the computer. Common examples: **Keyboard** — typing text/commands; **Mouse/Trackball/Glide-pad** — pointing and clicking; **Joystick/game devices** — controlling movement in games; **Light Pen** — drawing/selecting directly on screen; **Touch Screen** — direct finger/stylus input (ATMs, smartphones); **Digitizer/Graphic Tablet** — converts hand-drawn art to digital form; **Mic** — voice input; **Camera** — photo/video input; **POS Terminal & Scanners** — reading price/product data at checkout; **MIDI Keyboard** — musical input; **Wireless devices** — Bluetooth/RF keyboards and mice that remove the cable.

▼ Long Explain the storage mechanism of magnetic storage devices (tracks, sectors, clusters, cylinders). p. 8

ANSWER: A magnetic disk surface is divided into concentric circular rings called **tracks**. Each track is further divided into pie-shaped sections called **sectors**, which are the smallest unit the disk reads/writes in a single operation. The operating system groups a number of sectors together into a **cluster** to manage storage more efficiently. When a disk drive has several stacked platters, the same track number on every platter, taken together, is called a **cylinder** — data in one cylinder can be accessed without moving the read/write arm, which is faster. Retrieving data involves **seek time** (moving the head to the right track) plus **rotational delay** (waiting for the right sector to spin under the head), and together these make up the **access time**.

▼ Short Differentiate OCR, OMR, MICR, and OBR. p. 7

ANSWER: **OCR** (Optical Character Recognition) converts printed or handwritten text images into editable digital text. **OMR** (Optical Mark Recognition) detects filled-in marks on a sheet, used for checking OMR answer sheets. **MICR** (Magnetic Ink Character Recognition) reads special magnetic ink characters, mainly used on bank cheques. **OBR** (Optical Bar Recognition) reads barcodes printed on retail products at a checkout counter.

▼ Short Define Seek Time, Rotational Delay, Access Time, and Response Time. p. 9

ANSWER: **Seek Time** is the time the read/write head takes to move to the correct track. **Rotational Delay** (latency) is the time the disk takes to spin so that the required sector comes under the head. **Access Time** is the sum of seek time and rotational delay — the total time to locate the data. **Response Time** is the total time from the moment data is requested until the first byte is actually delivered to the user.

Unit 3 — Output Devices p. 10

▼ Long Differentiate between Impact and Non-Impact printers with examples. p. 11

ANSWER: **Impact printers** print by physically striking an inked ribbon against the paper, similar to a typewriter — they are noisy, relatively cheap, and can print carbon copies in one pass; examples include the Dot Matrix Printer and the Daisy Wheel Printer. **Non-Impact printers** transfer ink or toner onto paper without any physical striking action — they are quieter and produce higher-quality output, but usually cannot make carbon copies; examples include the Inkjet Printer and the Laser Printer.

▼ Short Explain any three non-CRT display units. p. 11

ANSWER: **LCD** (Liquid Crystal Display) is a flat panel that uses liquid crystals to control light, making it thin and energy-efficient. **LED** (Light Emitting Diode) display is essentially an LCD panel that is backlit by LEDs instead of older fluorescent tubes, giving better brightness and contrast. **Plasma Display** uses tiny cells of electrically charged gas to produce light, and is typically used in large-screen televisions.

▼ Short What is a plotter? Where is it used? p. 11

ANSWER: A plotter is an output device that draws precise, continuous line-based graphics using pens or ink jets, rather than building an image from dots like a printer. It is commonly used to produce engineering drawings, architectural blueprints, and maps that require high positional accuracy.

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Unit 4 — Numbering Systems and Codes p. 12

▼ Long Convert $(35)_{10}$ to Binary, Octal, and Hexadecimal. Show all steps. p. 12

ANSWER: To **Binary** (divide by 2): $35 \div 2 = 17$ r1, $17 \div 2 = 8$ r1, $8 \div 2 = 4$ r0, $4 \div 2 = 2$ r0, $2 \div 2 = 1$ r0, $1 \div 2 = 0$ r1 → reading remainders bottom-to-top gives **100011₂**. To **Octal** (divide by 8): $35 \div 8 = 4$ r3, $4 \div 8 = 0$ r4 → **43₈**. To **Hexadecimal** (divide by 16): $35 \div 16 = 2$ r3, $2 \div 16 = 0$ r2 → **23₁₆**. (Check: 100011_2 grouped in 3s = $100\ 011 = 4,3 \rightarrow 43_8 \checkmark$, matching the octal answer.)

▼ Long Explain binary subtraction using 1's and 2's complement methods with an example. p. 14

ANSWER: To subtract using **1's complement**: flip every bit of the number being subtracted (0→1, 1→0), add it to the first number, and if there is a leading carry, add that carry back into the result (end-around carry). Example: $1010 - 0011 \rightarrow$ 1's complement of 0011 is 1100 → $1010 + 1100 = 1\ 0110 \rightarrow$ add the carry back: $0110 + 1 = 0111 = 7$ (since $10 - 3 = 7 \checkmark$). To subtract using **2's complement**: take the 1's complement and add 1 to it, then add to the first number and simply discard any leading carry (no end-around addition needed). Example: 2's complement of 0011 = $1100 + 1 = 1101 \rightarrow 1010 + 1101 = 1\ 0111 \rightarrow$ discard the leading 1 → $0111 = 7 \checkmark$. 2's complement is preferred in real computer circuits because it needs no extra correction step.

▼ Short Differentiate ASCII, BCD, EBCDIC, and Unicode. p. 15

ANSWER: **ASCII** (American Standard Code for Information Interchange) is a 7/8-bit code representing English letters, digits and symbols (e.g. 'A' = 65 = 01000001). **BCD** (Binary Coded Decimal) stores each decimal digit separately as its own 4-bit binary group. **EBCDIC** (Extended Binary Coded Decimal Interchange Code) is an 8-bit character code used mainly on IBM mainframes. **Unicode** uses 16 bits or more so it can represent characters from virtually every language in the world, unlike ASCII which only covers English.

▼ Short Explain Even and Odd parity check with an example. p. 15

ANSWER: A parity bit is an extra bit added to a byte to detect transmission errors. In **even parity**, the parity bit is chosen so the total count of 1-bits (data bits + parity bit) is even; in **odd parity**, it is chosen so the total count is odd. Example: for data 1010001 (three 1-bits), an even-parity bit of 1 makes the total four 1-bits (even), while an odd-parity bit of 0 keeps the total at three 1-bits (odd).

▼ Short Define Bit, Nibble, Byte, Carry Bit, Sign Bit. p. 12

ANSWER: A **Bit** is a single binary digit (0 or 1), the smallest unit of data. A **Nibble** is a group of 4 bits. A **Byte** is a group of 8 bits and typically represents one character. A **Carry Bit** is generated when adding two bits produces a result exceeding the maximum single-digit value, so it is carried to the next column. A **Sign Bit** is the leftmost bit of a binary number used to indicate whether the number is positive (0) or negative (1).

Unit 5 — Languages, OS & Software p. 16

▼ Long Differentiate between Compiler and Interpreter. p. 16

ANSWER: A **Compiler** translates the entire high-level source program into machine code in one pass before execution begins; the resulting program then runs directly and fast, but any error is only reported after the whole program is scanned, and the compiled file is specific to one machine/OS. An **Interpreter** translates and executes the program line-by-line, without producing a separate machine-code file; it starts running immediately and reports errors as soon as they are hit, but is generally slower overall since translation happens every time the program runs. C uses a compiler, while languages like Python (and classic BASIC) traditionally use an interpreter.

▼ Long Explain the types of Operating Systems with examples. p. 17

ANSWER: A **Batch Operating System** groups similar jobs together and processes them as a batch with no user interaction during execution — e.g. old payroll-processing systems. A **Multi Processing Operating System** uses two or more CPUs within one system so that several processes truly run at the same time. A **Time Sharing Operating System** divides CPU time into small slices distributed among multiple users so quickly that each user feels they have the computer's full attention. An **Online and Real Time Operating System** processes data the instant it arrives and guarantees a response within a strict time limit — essential in systems like flight control or airbag sensors, where a late response is a failure.

▼ Short What are 3GL, 4GL, and 5GL languages? Give examples. p. 16

ANSWER: **3GL** (Third Generation Language) languages are procedural, English-like high-level languages such as C and Pascal. **4GL** (Fourth Generation Language) languages are closer to natural language and focus on "what" rather than "how", such as SQL. **5GL** (Fifth Generation Language) languages are problem-solving and AI-oriented, such as Prolog, where the programmer states constraints/goals and the system works out the steps.

Unit 6 — Emerging Technologies & Virus p. 18

▼ Long What is Cloud Computing? Explain its service models (IaaS, PaaS, SaaS). p. 19

ANSWER: Cloud Computing is the delivery of computing services — servers, storage, databases and software — over the internet, so an organisation can use computing resources on demand instead of owning and maintaining physical hardware. Its three service models are layered like a pyramid: **IaaS** (Infrastructure as a Service) rents raw computing infrastructure such as virtual servers and storage, and the customer manages everything above that — e.g. AWS EC2, Google Compute Engine. **PaaS** (Platform as a Service) additionally provides the runtime platform and development tools so the customer only manages their application code — e.g. Google App Engine, Azure App Service. **SaaS** (Software as a Service) delivers a complete, ready-to-use application over the internet, and the customer simply uses it with nothing to install or manage — e.g. Gmail, Netflix, MS 365.

▼ Long What is a computer virus? Explain its types and preventive measures. p. 18

ANSWER: A computer virus is a malicious, self-replicating program that attaches itself to a host file or program and spreads from one computer to another, often corrupting or destroying data. Common types: **Boot Sector Virus** infects the master boot record and activates at system start-up; **File Infector Virus** attaches to executable files and spreads when the file is run; **Macro Virus** hides inside document macros (e.g. Word/Excel); **Worm** self-replicates and spreads across a network without needing a host file or user action; **Trojan Horse** disguises itself as legitimate software while carrying hidden malicious code; **Ransomware** encrypts the victim's data and demands payment for the decryption key. Preventive measures include installing and regularly updating trusted antivirus software, avoiding downloads/attachments from unknown sources, keeping the OS and applications patched, taking regular data backups, and using a firewall while scanning external drives before opening them.

▼ Short Differentiate GSM and CDMA. p. 18

ANSWER: Both GSM and CDMA are mobile communication standards. **GSM** (Global System for Mobile communication) uses a removable SIM card and divides each radio channel into time slots shared among users (time-division access). **CDMA** (Code Division Multiple Access) does not typically use a removable SIM in the same way and instead gives every user a unique code so multiple users can share the same frequency simultaneously (code/spread-spectrum access).

▼ Short What is the difference between Bluetooth and Wi-Fi? p. 18

ANSWER: **Bluetooth** is a short-range (a few metres), low-power wireless technology mainly used for direct device-to-device connections, such as connecting a phone to earphones. **Wi-Fi** has a much longer range, offers higher data speed, and is used to connect multiple devices to a shared network (like a router), typically for internet access.



Quick Summary — The Whole Subject in One Page

Final revision before the exam — read this page the night before

Unit 1

- Computer = Data → Process → Information
- Analog / Digital / Hybrid; Micro / Mini / Mainframe / Super
- 5 Generations: Tubes → Transistors → IC → Microprocessor → AI
- CPU = Control Unit + ALU + Memory
- RAM (volatile) vs ROM (non-volatile)

Unit 2 & 3

- Input: keyboard, mouse, scanner types (OCR/OMR/MICR/OBR)
- Storage: track, sector, cluster, cylinder
- Seek time + rotational delay = access time
- Output: CRT vs LCD/LED/Plasma
- Printers: Impact vs Non-Impact

Unit 4

- Bit → Nibble → Byte → KB → MB → GB → TB
- Binary, Octal, Decimal, Hex conversions
- 1's / 2's complement for subtraction
- ASCII, BCD, EBCDIC, Unicode
- Even/Odd parity for error detection

Unit 5

- Assembler / Compiler / Interpreter
- Machine → Assembly → High-level (3GL-5GL)
- OS: Batch, Multi-processing, Time-sharing, Real-time
- Software packages: Word, Excel, DB, Presentation

Unit 6

- GIS, GPS, CDMA, GSM, Bluetooth, Wi-Fi, Li-Fi
- Virus types: boot, file, macro, worm, trojan, ransomware
- Protect: antivirus, updates, backups, firewall
- Cloud: IaaS → PaaS → SaaS

Exam Strategy

- Practise number system conversions numerically — guaranteed marks
- Learn one example per device/term — examiners love examples
- Draw the block diagram (Input→CPU→Output) from memory
- Revise the Glossary and the Exam Q&A answers the night before

CS-03 Computer Fundamentals & Emerging Technology · Study Guide compiled from the Saurashtra University B.C.A. (Honours) syllabus, effective June 2023.

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