

CHAPTER 1

Introduction to Systems

CLASS 9

COMPUTER SCIENCE & ENTREPRENEURSHIP

Solved Exercise

Multiple Choice Questions • Short Questions
Long Questions • Explained Step by Step



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EXERCISE

Multiple Choice Questions

✓ The correct option in every question is highlighted in green and ticked, with an explanation below it.

1. What is the primary function of a system?

- a) To work independently
- b) To achieve a common goal ✓**
- c) To create new systems
- d) To provide entertainment

✓ **Correct Answer: (b)**

Explanation: A system is a set of interconnected components working together. The primary reason they work together is to achieve a specific, unified objective or common goal. Working independently contradicts the very concept of a system, while creating new systems or providing entertainment are just specific types of goals a system might have, not its primary universal function.

2. What is one of the fundamental concepts of any system?

a) Its size

b) Its objective



c) Its age

d) Its price

✓ **Correct Answer: (b)**

Explanation: Every system exists for a purpose. Without an objective (or goal), the components wouldn't know how to interact or what to achieve. Size, age, and price are variable attributes that change depending on the system, but the objective is the fundamental reason for its existence.

3. What is an example of a simple system?

- a) A human body
- b) A computer network
- c) A thermostat regulating temperature ✓**
- d) The Internet

✓ **Correct Answer: (c)**

Explanation: A thermostat is a simple, closed-loop control system consisting of a sensor, a controller, and a heater/AC unit working together to maintain a specific temperature. A human body, computer network, and the Internet are highly complex systems with countless interconnected components and subsystems.

4. What type of environment remains unchanged unless the system provides an output?

a) Dynamic

b) **Static**



c) Deterministic

d) Non-deterministic

✓ **Correct Answer: (b)**

Explanation: A static environment is one that does not change over time unless acted upon by the system itself. In contrast, a dynamic environment changes continuously regardless of the system's actions. Deterministic and non-deterministic refer to the predictability of outcomes, not whether the environment changes.

5. What are the basic components of a system?

a) Users, hardware, software

b) **Objectives, components, environment, communication** ✓

c) Inputs, outputs, processes

d) Sensors, actuators, controllers

✓ Correct Answer: (b)

Explanation: The fundamental components of any system are its objectives (why it exists), components (the parts), environment (the surroundings it interacts with), and communication (how the parts interact). Inputs, outputs, and processes are aspects of system operation, but not the high-level structural components. Hardware/software are specific to computer systems.

6. What concept does the theory of systems aim to understand?

a) Hardware design

b) **System interactions and development over time** ✓

c) Software applications

d) Network security

✓ Correct Answer: (b)

Explanation: General systems theory is an interdisciplinary study of systems. It aims to understand the principles of organization, interaction, and the dynamics of systems as a whole, regardless of their specific domain (whether biological, mechanical, or computational), rather than focusing on specific hardware, software, or security details.

7. What role does the Operating System (OS) play in a computer?

- a) It performs calculations and executes instructions
- b) It temporarily stores data and instructions for the CPU
- c) It receives input from interface components and decides what to do with it ✓**
- d) It provides long-term storage of data and software

✓ Correct Answer: (c)

Explanation: The Operating System (OS) acts as an intermediary between the user and the computer hardware. It manages hardware resources, handles input from interface components (like keyboards and mice), and decides how to process that input by allocating CPU time and memory to different tasks. CPU performs calculations, RAM temporarily stores data, and long-term storage is handled by drives.

8. Which of the following describes the Von Neumann architecture's main characteristic?

- a) Separate memory for data and instructions
- b) Parallel execution of instructions
- c) Single memory store for both program instructions and data ✓**
- d) Multiple CPUs for different tasks

✓ Correct Answer: (c)

Explanation: The defining feature of the Von Neumann architecture is the concept of a stored-program computer, where both the program instructions and the data it processes are stored in the same read-write memory (RAM). This contrasts with Harvard architecture, which uses separate memories for instructions and data.

9. What is a disadvantage of the Von Neumann architecture?

- a) Complex design due to separate memory spaces
- b) Difficult to modify programs stored in memory
- c) Bottleneck due to single memory space for instructions and data ✓**
- d) Lack of flexibility in executing instructions

✓ Correct Answer: (c)

Explanation: Because instructions and data share the same memory and the same bus to the CPU, the CPU cannot fetch an instruction and read/write data at the same time. This creates a performance limitation known as the Von Neumann bottleneck. The design is actually simpler (no separate memory spaces), programs are easy to modify, and it is very flexible.

10. Which of the following transports data inside a computer among different components?

a) Control Unit

b) System Bus



c) Memory

d) Processor

✓ **Correct Answer: (b)**

Explanation: The System Bus is the physical pathway (comprising data, address, and control buses) that connects the CPU, memory, and I/O devices, allowing data and control signals to be transferred between them. The Control Unit directs operations, Memory stores data, and the Processor executes instructions.

Short Questions

Q1. Define a system. What are its basic components?

Answer:

A system is a set of interconnected or interdependent components working together to achieve a specific objective. Its basic components are:

- **Objectives:** The goal the system aims to achieve.
- **Components:** The individual parts that make up the system.
- **Environment:** The surroundings outside the system that it interacts with.
- **Communication:** The exchange of information between components.

Q2. Differentiate between natural and artificial systems.

Answer:

- **Natural Systems:** These exist in nature without human intervention. They are self-regulating and evolve naturally. *Examples:* The solar system, the human body, and ecosystems.
- **Artificial Systems:** These are created by humans to achieve specific goals or solve problems. They are designed with specific boundaries and objectives. *Examples:*

Computer systems, transportation networks, and educational systems.

Q3. Describe the main components of a computer system.

Answer:

The main components of a computer system are:

- **Hardware:** The physical parts (CPU, RAM, motherboard, keyboard).
- **Software:** The instructions and programs (Operating System, applications).
- **Data:** Raw facts and figures processed by the computer.
- **Users:** People who operate the system.
- **Procedures:** Instructions or rules for operating the system.

Q4. List and describe the types of computing systems.

Answer:

- **Personal Computers (PCs):** General-purpose computers for individual use.
- **Servers:** Provide services to other computers over a network.
- **Mainframes:** Large, powerful computers for bulk data processing.
- **Supercomputers:** Extremely fast computers for complex scientific calculations.

- **Embedded Systems:** Computers built into other devices for specific control tasks.

Q5. What are the main components of the Von Neumann architecture?

Answer:

The main components are the Central Processing Unit (CPU) containing the Control Unit and Arithmetic Logic Unit (ALU), Memory (RAM), Input/Output interfaces, and the System Bus connecting them.

Q6. What is the Von Neumann computer architecture? List its key components.

Answer:

It is a computer architecture design based on the stored-program concept where instructions and data share the same memory. **Key components:** CPU (Control Unit, ALU, Registers), Memory Unit, Input Devices, Output Devices, and Buses.

Q7. What are the four main steps in the Von Neumann architecture's instruction cycle?

Answer:

The four steps are:

1. **Fetch:** Retrieve instruction from memory.

2. **Decode:** Translate the instruction.
 3. **Execute:** Perform the operation.
 4. **Store:** Write back the result if necessary.
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Q8. What is the Von Neumann bottleneck?

Answer:

It is the performance limitation caused by the single shared bus between the CPU and memory. Because instructions and data cannot be accessed simultaneously, the CPU often has to wait for data to be transferred, slowing down processing.

Q9. What is a key advantage of the Von Neumann architecture?

Answer:

A key advantage is its simplicity and flexibility. Because instructions and data share the same memory, programs can be easily modified, and the same hardware can be used for vastly different tasks by simply changing the software.

Q10. What are the three main requirements for a computing system to function?

Answer:

Hardware (physical components), **Software** (programs and instructions), and **Data** (the raw information to be processed).

Long Questions

Q1. Define and describe the concept of a system. Explain the fundamental components, objectives, environment, and methods of communication within a system.

Answer:

A system is a cohesive group of interrelated and interdependent components that work together toward a common goal. The concept emphasizes that the whole is greater than the sum of its parts.

- **Components:** The individual parts or subsystems that make up the whole (e.g., CPU, RAM in a computer).
 - **Objectives:** The specific purpose or goal the system is designed to achieve (e.g., processing data).
 - **Environment:** Everything outside the system boundary that interacts with it (e.g., users, power supply, other networks).
 - **Communication:** The exchange of information, signals, or data between components within the system, and between the system and its environment, enabling coordination and control.
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Q2. Differentiate between natural and artificial systems. Discuss their characteristics, functions, and purposes with relevant examples.

Answer:

- **Natural Systems:** Exist inherently in the universe without human design. They are self-regulating and evolve over long periods. *Characteristics:* Adaptive, complex, governed by natural laws. *Examples:* The solar system, human body, ecosystems. *Function/Purpose:* Maintain balance, sustain life, follow physical laws.
 - **Artificial Systems:** Created by humans to serve specific needs or solve problems. They are designed with specific boundaries and objectives. *Characteristics:* Predictable, purpose-driven, require maintenance. *Examples:* Computer networks, banking systems, cars. *Function/Purpose:* Automate tasks, process information, provide transportation, achieve human-defined goals.
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Q3. Examine the relationship between systems and different branches of science, including natural science, design science, and computer science. How do these branches utilize system theory to understand and improve their respective fields? Provide specific examples to support your analysis.

Answer:

Systems theory provides a unified framework for understanding complex phenomena across disciplines.

- **Natural Science:** Biologists study the human body as a system (circulatory, nervous systems) where organs (components) communicate to maintain homeostasis (objective). Ecologists study ecosystems where organisms interact with the environment.
 - **Design Science:** Engineers design artificial systems (e.g., a bridge or a car engine). They analyze components, materials, and environmental stresses to ensure the system achieves its objective (safe transportation) without failure.
 - **Computer Science:** Computer scientists design hardware and software systems. An Operating System manages hardware components (CPU, memory) and communicates with application software to achieve efficient processing. System theory helps in understanding concepts like deadlocks, resource allocation, and network protocols.
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Q4. Explore the different types of computing systems such as computers, software systems, computer networks, and the internet.

Answer:

- **Computer Hardware Systems:** Physical devices like desktops, laptops, and supercomputers designed to execute instructions.
- **Software Systems:** Logical systems consisting of programs and data. Examples include Operating Systems (managing hardware) and Application Software (e.g., MS Word, games).
- **Computer Networks:** Systems of interconnected computers that share resources and communicate. Examples: Local Area Networks (LANs), Wide Area Networks (WANs).
- **The Internet:** A global system of interconnected computer networks that use standard protocols (TCP/IP) to serve billions of users worldwide, enabling communication, data transfer, and the World Wide Web.

Q5. Describe the main characteristics of a computer as a system, including its objectives, components, and interactions among these components.

Answer:

A computer is an artificial, deterministic system.

- **Objectives:** To process data into meaningful information, perform calculations, and automate tasks.
- **Components:** Hardware (CPU, memory, I/O devices) and Software (OS, applications).
- **Interactions:** The Control Unit directs the flow of data between the ALU, memory, and I/O devices via the system bus. The OS manages these interactions, ensuring that different applications can run simultaneously without conflict.

Q6. Explain the Von Neumann architecture of a computer. Include a discussion on the main components, their functions, and the step-by-step process of how the architecture operates.

Answer:

Proposed by John von Neumann, this architecture is based on the stored-program concept.

Main Components: CPU (Control Unit, ALU, Registers), Memory (RAM), Input/Output devices, and the System Bus.

Step-by-Step Process (Instruction Cycle):

1. **Fetch:** The Control Unit fetches the next instruction from memory using the Program Counter.
2. **Decode:** The instruction is decoded to determine what operation is needed.

3. **Execute:** The ALU or Control Unit performs the operation (e.g., addition, data movement).
 4. **Store:** The result is written back to memory or a register.
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Q7. Provide a detailed explanation of how a computer interacts with its environment. Include examples of user input, network communication, and power supply.

Answer:

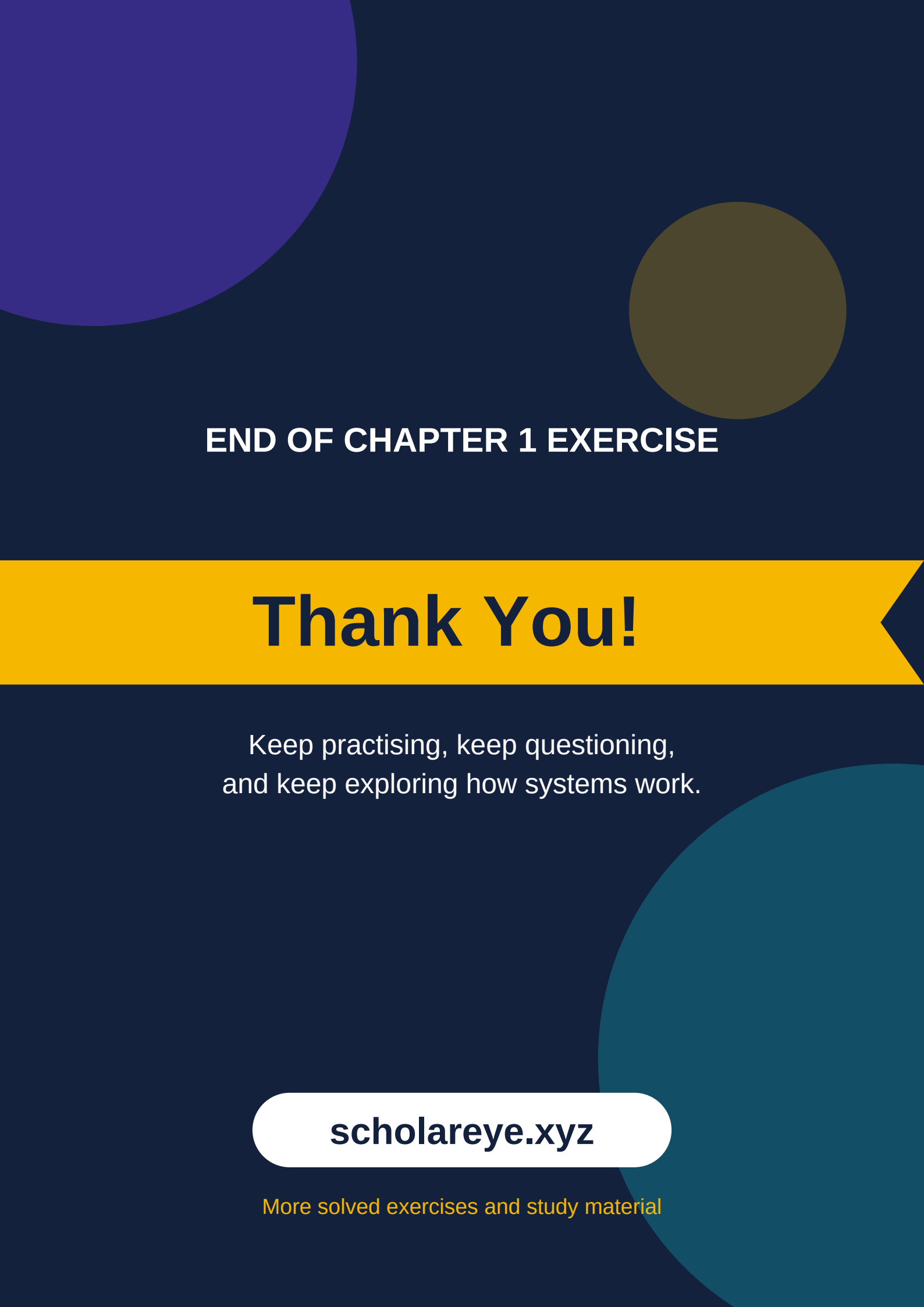
A computer interacts with its environment through Input/Output (I/O) interfaces.

- **User Input:** Users interact via peripherals (keyboard, mouse, touchscreen). These devices convert physical actions into digital signals (binary) that the computer's I/O controllers can process.
 - **Network Communication:** The computer uses Network Interface Cards (NICs) to send and receive data packets over the internet or LAN, interacting with other systems. Protocols ensure data is formatted correctly for transmission.
 - **Power Supply:** The computer interacts with the electrical environment via the Power Supply Unit (PSU), which converts AC power into stable DC voltages required by internal components.
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Q8. Describe the process of retrieving and displaying a file using a computer, based on the interactions among different components. Provide a step-by-step explanation of how input is processed, data is transferred, and results are displayed on the screen.

Answer:

1. **User Input:** The user double-clicks a file icon. The mouse sends a signal to the computer via the USB port.
 2. **OS Processing:** The Operating System receives this input. It determines that the user wants to open a specific file located on the Hard Drive (Secondary Storage).
 3. **Data Transfer:** The OS sends a command to the disk controller. The hard drive locates the file's sectors and transfers the data through the system bus into the Main Memory (RAM).
 4. **Processing:** The CPU fetches the data from RAM, decodes the file format, and processes the instructions needed to render the file (e.g., interpreting image pixels or text characters).
 5. **Output:** The CPU sends the processed graphical data to the GPU/Display controller, which outputs the visual information to the monitor, displaying the file on the screen.
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END OF CHAPTER 1 EXERCISE

Thank You!

Keep practising, keep questioning,
and keep exploring how systems work.

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More solved exercises and study material