Unit no. 01: Introduction to Systems

Exercise:

Give short answers to the questions:

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

A system is a group of different parts that work together to complete a specific task or achieve a goal. In computer science, a system is usually made up of hardware, software, data, users, and procedures.

The basic components of a system are:

Input: Data or instructions that enter the system.

Process: The system works on the input and processes it to get results.

Output: The final result or outcome after processing.

Feedback (optional): Sometimes, output is used to improve the system.

For example, in a computer system, when you type using a keyboard (input), the computer processes it, and the result appears on the screen (output).

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2. Differentiate between natural and artificial systems.

Natural systems are created by nature and exist without human involvement.

Examples include the human body, the solar system, or a river ecosystem. These systems follow natural laws and maintain themselves automatically.

Artificial systems, on the other hand, are created by humans to perform specific tasks. Examples include computers, washing machines, and schools. These systems are designed for a purpose and can be changed or controlled by humans.

Difference in summary:

Origin:	Natural systems are made by nature;	artificial systems are man-made.
Function:	Natural systems work on natural processes;	artificial systems work based on design and programming.

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3. Describe the main components of a computer system.

A computer system has several important parts that work together:

1. Input Devices: Used to enter data into the computer (e.g., keyboard, mouse).

2. Output Devices: Show the result of the computer's processing (e.g., monitor, printer).

3. Central Processing Unit (CPU): The brain of the computer that processes data and controls operations. It includes the Control Unit (CU) and Arithmetic Logic Unit (ALU).

4. Memory/Storage: Stores data and instructions. This includes RAM (temporary) and hard drive/SSD (permanent).

5. Software: Programs and applications that tell the hardware what to do.

6. Users: The people who operate the computer.

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4. List and describe the types of computing systems.

There are different types of computing systems based on their size and use:

1. Personal Computers (PCs): Used at homes, schools, and offices for personal tasks.

2. Laptops: Portable computers with all basic features of a PC.

3. Servers: Powerful computers used in businesses to manage data, networks, and services.

4. Supercomputers: Very fast computers used in science and research for complex calculations.

5. Embedded Systems: Small computers built inside machines like microwaves, cars, or washing machines.

6. Mobile Devices: Smartphones and tablets used for communication and internet access.

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

Von Neumann architecture is a model that shows how a computer works. Its main components are:

1. Input Unit: Receives data and instructions from outside.

2. Memory Unit: Stores both data and instructions in the same memory.

3. Control Unit: Directs the operations of the computer.

4. Arithmetic Logic Unit (ALU): Performs all arithmetic and logic operations.

5. Output Unit: Displays or sends results to the user.

These parts work together in a cycle to perform tasks.

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

Von Neumann computer architecture is a design model for modern computers in which data and instructions are stored together in a single memory. This model is widely used in today's computers.

Key components include:

Input Unit: Takes data into the system.

Memory Unit: Stores data and instructions.

Control Unit: Manages and coordinates the entire system.

ALU (Arithmetic Logic Unit): Does all calculations and logical decisions.

Output Unit: Provides the result to the user.

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

The instruction cycle is the process a computer follows to run instructions. The four main steps are:

1. Fetch: The control unit gets the instruction from memory.

2. Decode: The instructions are translated so the computer understands what to do.

3. Execute: The CPU performs the required task (like adding numbers).

4. Store: The result is stored in memory or sent to an output device.

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8. What is the Von Neumann bottleneck?

The **Von Neumann bottleneck** is a problem where the computer has only one path (bus) for both data and instructions to move between the CPU and memory. Because of this, the CPU sometimes has to wait, which slows down performance. It's like a single-lane road where only one car can move at a time—causing traffic.

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9. What is the key advantage of the Von Neumann architecture?

The main advantage is that data and instructions are stored in the same memory, which makes the design simpler and cheaper. This reduces the cost and complexity of building computers. It also allows programs to be stored and modified easily.

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

A computing system needs the following three things to work properly:

1. Hardware: The physical parts of a computer, like the CPU, monitor, keyboard, etc.

2. Software: The instructions or programs that tell the hardware what to do (e.g., Windows, MS Word).

3. User: The person who uses and operates the system by giving commands and receiving results.