**Notes**

*Computer Organization*

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Computer Organization: The group of attributes of a computer system including control signals, signaling methods, memory types, all physical aspects of computer systems, and how the system works.

Computer Architecture: The group of attributes of a computer system including the structure and behavior of the system, the logical and abstract aspects of system implementation as seen by programmers, instruction sets and formats, operation codes, data types, the number and types of registers, addressing modes, main memory access methods, and various I/O mechanisms, and how the system is designed.

Instruction Set Architecture: The interface between all software that runs on a machine and the hardware that executes it.

Principle of equivalence of hardware and software: Any task done by software can also be done using hardware, and any operation performed directly by hardware can be done using software.

Computer: A device consisting of a Central Processing Unit to interpret and execute programs; memory to store both data and programs; and a mechanism for transferring data to and from the outside world.

Central Processing Unit: A device consisting of an Arithmetic Logic Unit to perform computations and make decisions; a control unit directing data to correct locations; and registers to hold data that the device needs to access quickly. The ALU is connected to the registers and both are connected to memory by buses.

Memory: Hardware used to store anything that a computer needs. Memory includes long-term memory, such as disk drives and flash drives, which stores data needed in the future, even when the power is off, and temporary memory, such as registers and RAM, which stores information the CPU is presently working on and loses data when it loses power.

Datapath: The collection of ALU, registers, and bus that is ultimately responsible for running programs.

Input/Output Component: A device that allow humans to communicate with computers.

Computer: An assembly of hardware used to receive input, process input, and generate output.

Computer System: A combination of hardware and software. Types of computer systems include supercomputers (used for compute-intensive applications), mainframes (used for data processing and financial transactions), personal computers (desktops and laptops), mobile devices (hand-held portable computing devices), and embedded systems.

System software: The collection of programs, including operating system, that allow a human to use a computer, integrates with computer hardware, and serves as an interface between a human and the computer hardware.

Application software: Software for such tasks as email and word processing.

Utility software: Software for such tasks as cleaning up a hard drive or protecting a computer.

Power-of-10 prefixes are ordinarily used for power, electrical voltage, frequency (such as computer clock speeds), and multiples of bits (such as data speeds in number of bits per second). Typically, power-of-10 prefixes are lowercase (e.g., k), while power-of-2 prefixes are uppercase and sometimes followed by an “i” (e.g., K or Ki). Power-of-two prefixes are ordinary used for size of objects in memory.

Virtual machine: A hypothetical computer of a certain degree of abstraction away from hardware.

von-Neumann System: A stored-program computer system using a von-Neumann architecture that consists of a Central Processing Unit with a control unit, an Arithmetic Logic Unit, registers, and a program counter; a main-memory system (which holds programs that control the computer’s operation); and an Input/Output system; that has the capacity to carry out sequential instruction processing; and that contains of a single physical or logical path between the main-memory system and the control unit of the CPU which forces alternation of instruction and execution cycles.

von-Neumann execution cycle: The fetch-decode-execute cycle in which the control unit fetches the next program instruction from memory, using the program counter to determine where the instruction is located; the instruction is decoded into a language the ALU can understand; any data operands required to execute the instruction are fetched from memory and placed in registers in the CPU; and the ALU executes the instruction and places the results in registers or memory.