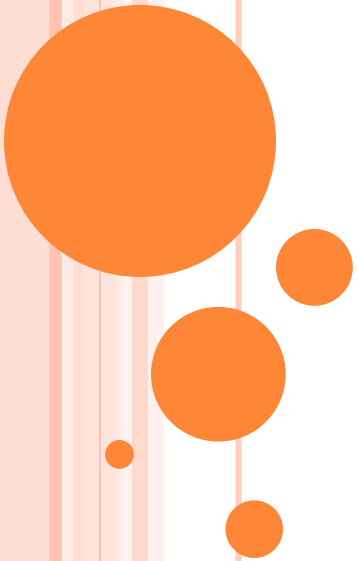


System Unit

CS-305

System Unit

- Contains different electronic components of the computer used to process data.
- Made of plastic or metal to protect the components inside it.
- Available in different shapes and sizes.
- System unit typically contains:

1. Motherboard
2. CPU
3. Memory
4. Hard disk
5. Other electronic components

1. MOTHERBOARD

- Motherboard is a communication medium for entire computer system.
- Main circuit board inside the system unit.
- Also known system board or main board.
- All components of the computer system are connected to the Motherboard.
- Some electronic built in the motherboard and some can be attached it.

1. Motherboard

- Some important components of motherboard are as follows:
  - Port: A connection point that is peripheral devices to the motherboard.
  - Expansion slot: A component located on the motherboard that enables you to connect an expansion card.
  - Drive Controller: Provides drive interface.

1. Motherboard

- BIOS: It is a program stored on a chip on the motherboard that is used to start up the computer.
- Memory Slot: Hold memory modules.
- CPU socket: Used to hold the processor.
- Bus: Data flows between computer components via bus.

2. Central Processing Unit

- CPU stands for central processing unit.
- It is the brain of the computer.
- Also called Processor.
- A computer cannot work without CPU.
- Located on the motherboard.
- It carries out the most of the work of a computer.
- Performs all operations on data according to the given instructions.

2. Central Processing Unit

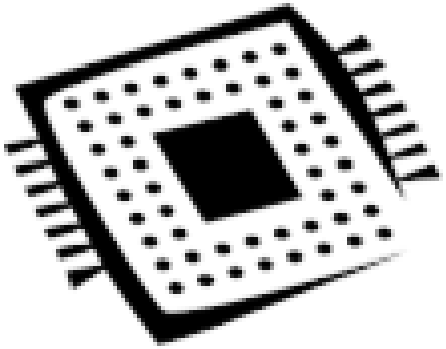
- It executes instruction and tells the other parts of computer what to do.
- All functions of processor usually are on a single chip in personal computers.
- The manufacture of processor chip are also providing multi-core processors.
- A single chip that contains two or more separate processors is known as Multi-core processors.

2. Central Processing Unit

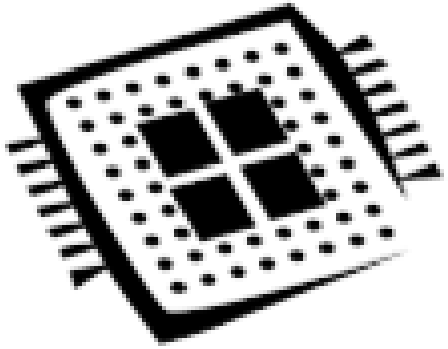
- Multi-core processing reduces access time and increase overall processing.
- Example: If one core is busy in executing an instructions, another can handle incoming data or instructions.
- It reduces energy consumption over multiple separate processors.
- Multi-core processor include : Dual core, quad core, six core and eight core.
- Dual -core CPU: Contains two separate processors
- Quad- core CPU: Contains four separate processors

2. Central Processing Unit

Single Core CPU



Multi-core CPU



2. Central Processing Unit

- CPU consists of two main units

1. Arithmetic and logical unit
2. Control unit

2. Central Processing Unit

- Arithmetic unit : Performs basic arithmetic functions such as addition, subtraction, multiplication and division.
- logical unit: Performs logical operations like comparing two items to find which data item is greater than, equal to, or less than other.

2. Central Processing Unit

Control unit :

- Act like a supervisor of the processor.
- It does not execute program instructions by itself.
- It controls and coordinates all activities of computer system.
- It performs this tasks by issuing necessary commands to different components of computer.
- Provides clock pulses that are used to regulate and control all operations in the computer system

2. Central Processing Unit

Control unit :

- It fetches instructions from the main memory.
- It interprets the instructions to find what operation is to be performed.
- It controls the execution of instructions.

2.1 Machine cycle

- Machine cycle is the sequence of actions performed by the processor to execute each instructions.
- Four steps of machine cycle:

1. Fetch
2. Decode
3. Execute
4. Storing

2.1 Machine cycle

1. Fetch:

Getting an instruction from memory to execute it. This process is performed by the control unit.

2. Decode:

The control unit decodes the instructions. This process examines the nature of instruction to determine what further operations should be taken. CU directs to move the required data from memory to ALU.

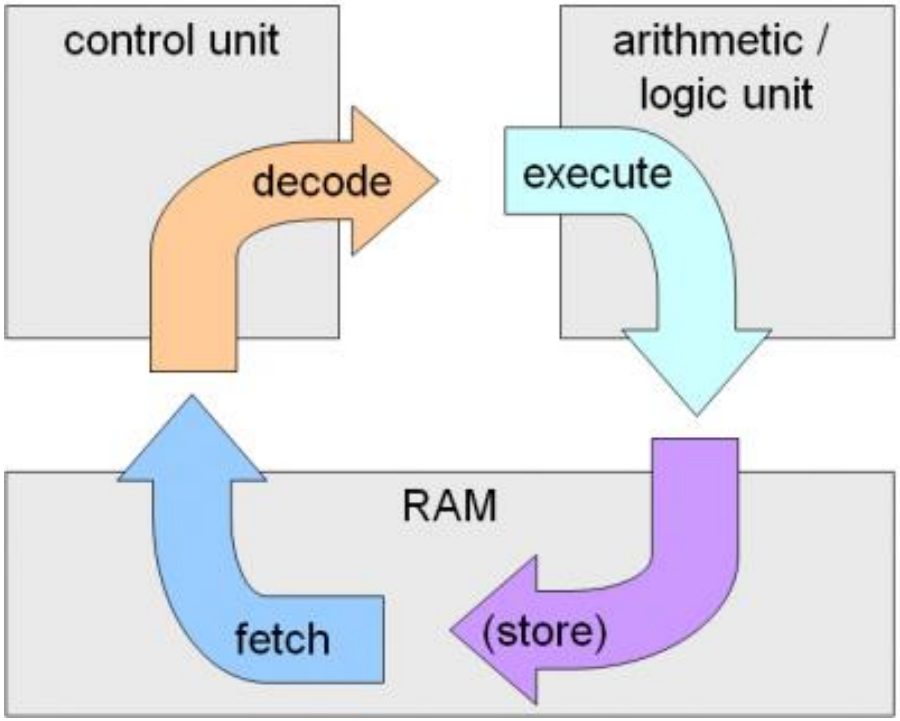
3. Execute:

CPU finally executes the instructions. The instructions is executed by ALU.

4. Storing :

The process of writing the result to the memory.

2.1 Machine cycle



2.2 Instruction set

- A set of bits that tells a computer to perform a specific task is called instruction or instruction code.
- Instructions are loaded into memory.
- CPU fetches instructions from memory to execute it.
- Each CPU provides number of instructions to perform different operations.
- All instructions provides by the CPU is called instruction set.

2.2 Instruction set

Types of Instructions

1. Data Transfer Instructions
2. Data Processing Instructions
3. Program Control Instructions

2.2 INSTRUCTION SET

1. Data Transfer Instructions:

Used to transfer data from one location to other location in the computer. These instructions do not change the data.

- MOV(Move) :
- ✓ To transfer data from memory to register
- ✓ register to memory,
- ✓ register to register
- ✓ Also used to store the result of calculation.
- LD(load):
- ✓ Used to load a register with the contents from the memory.
- ✓ Example: Instruction will load 25 in register A : LD A, 25
- XCHG(exchange):
- ✓ Used to exchange the value of two registers.
- ✓ Example: Instruction will change the value values of CX and BX.

2.2 Instruction set

Types of Instructions

2. Data Processing Instructions:

- ✓ Used to perform arithmetic and logical calculations on data.
- ✓ Calculations are performed on the values of registers.
- ✓ The result is also stored in registers.

❖ Arithmetic Instructions:

- ✓ ADD for addition, SUB for subtraction, MUL for multiplication and DIV for division.

❖ Logical Instructions:

- ✓ Used to perform logical operations AND, OR and NOT.

❖ Shift Instructions:

- ✓ Used to transfer bits of an operands from left to right and right to left.

2.2 Instruction set

Types of Instructions

3. Program Control Instructions:

- ✓ Used to control the execution of different instructions in a program.
- ✓ They can be used to change the order in which instructions are executed.

❖ JMP (jump):

- ✓ Used to move control from one place to other in a program.

❖ LOOP:

- ✓ Used to execute a statement or set of statements repeatedly for a number of times.

2.3 System Clock

- Electronic Component.
- Generates electrical signal at a fast speed.
- Controls all functions of the computer using clock ticks.
- These ticks of system clock are known as clock cycle.
- Computer clock can tick from millions to billion times in one second.

2.3 System Clock

- The speed at which the CPU executes instructions is called Clock speed or clock rate.
- Speed measure in MHz and GHz.
- Hertz means cycle per second.
- MHz is a million of cycles per second and GHz means billion of cycles.
- The power of CPU is determined by the speed at which it processes data.

2.3 System Clock

- MIPS(million of instruction per second):
  - Speed of workstation and some server computers is measured in MIPS.
  - Workstation perform at 100 MIPS or more.
  - Mainframes perform at 200-1200 MIPS.
  - MIPS is also applied in PC's.
- FLOPS (floating point operations per second):
  - Super computer processing speed is measured in flops.
  - Supercomputer applications are often scientific and frequently performing floating point operations.
  - FLOPS accommodate very small or very large numbers.
  - Speed of modern computers is more than a trillion FLOPS.

2.4 Types of CPU architecture

- Two types of CPU architecture:

1. CISC Architecture
2. RSIC Architecture

2.4 Types of CPU architecture

- Two types of CPU architecture:

1. CISC Architecture

- ✓ Stands for Complex instruction set computing.
- ✓ Traditional type of CPU.
- ✓ Supports a large number of instructions.
- ✓ Executes complex instruction more quickly.
- ✓ Uses more complex circuits to decode the instructions.
- ✓ It requires multiple clock cycles to execute an instruction.
- ✓ Examples: Intel's 486 and Pentium series

2.4 Types of CPU architecture

- Two types of CPU architecture:

2. RISC Architecture

- ✓ Stands for Reduced instruction set computing.
- ✓ Only contains most frequently instructions.
- ✓ Execute simple instructions more quickly than CISC CPU.
- ✓ It completes most of the instructions in one machine cycle.
- ✓ Examples: IBM PowerPC, Sun SPARC and table PCs.

2.4 Types of CPU architecture

- Two types of CPU architecture:

2. RISC Architecture

- ✓ It allows the processor to handle several instructions at the same time.
- ✓ Uses less power.
- ✓ Developed in less time because its design is simple as compared to CISC Processor.

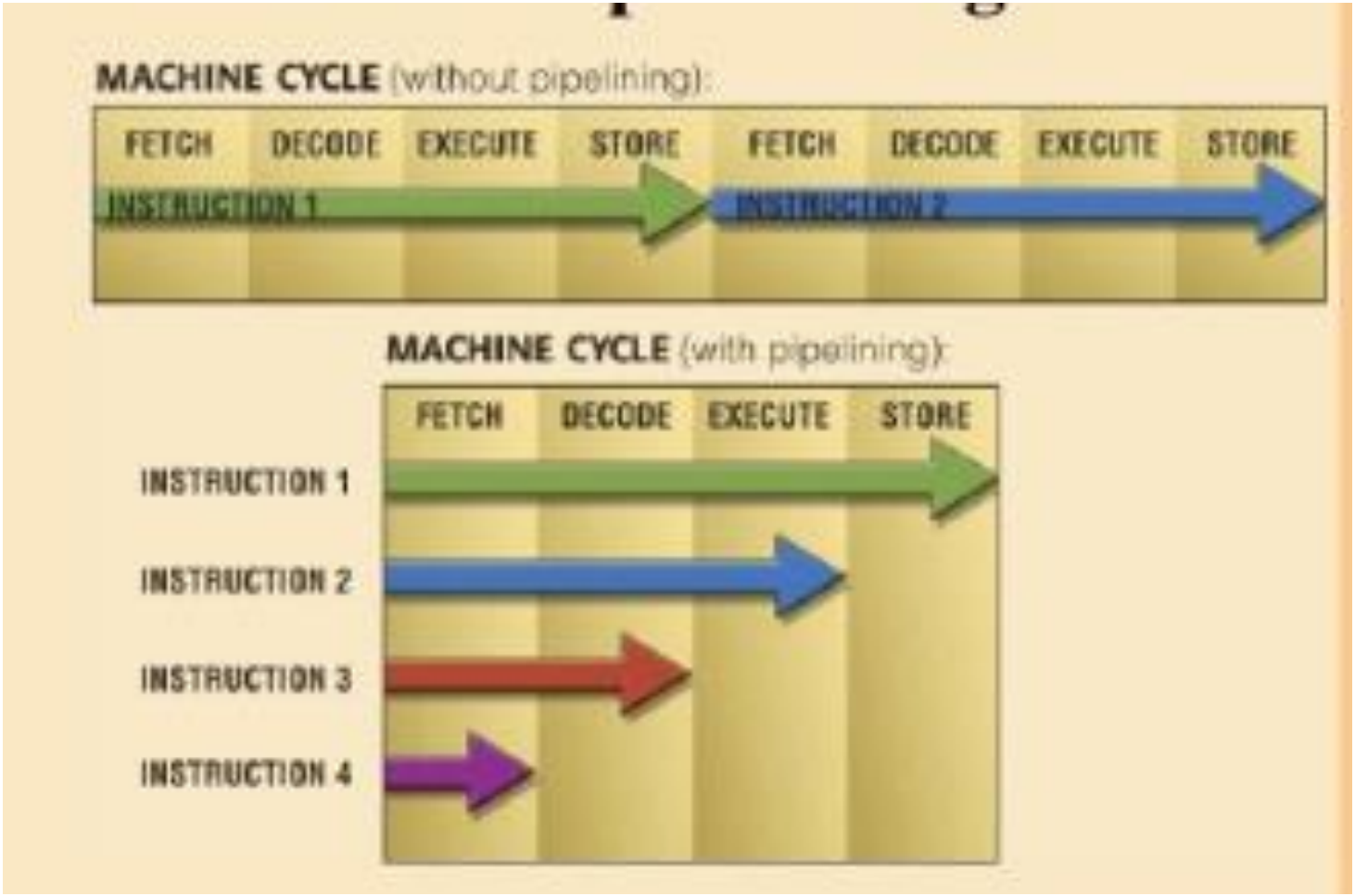
2.5 Pipelining

- Pipelining is a technique in which CPU fetches the next instruction before it completes the machine cycle for the first instruction.
- Modern computers use pipelining technique to process multiple instructions at the same time.
- It results in faster processing and increased the performance of the computer.

2.5 Pipelining

- Without pipelining the processor fetches, decodes, executes and stores only one instruction at a time.
- The CPU waits until an instruction completes its all four stages and then executes the next instructions.

2.5 Pipelining



2.6 Registers

- A small high speed memory inside CPU.
- The CPU contains number of registers.
- Registers are used to store information being processed.
- These are temporary storage areas for instructions.
- The temporary results during processing are also stored in registers.
- Each registers has a predefined functions.

2.6 Registers

- Registers size determines how much information it can store.
- The size of the registers in the bytes.
- Each byte can store one character of the data.
- A register can be 1, 2, 4, 8 bytes.
- Bigger size of the register increases the performance of CPU.

2.6 Registers

- ✓ CU manages registers for the following purposes:
- Input the instructions or data
- Store the instructions or data
- Transfer the instructions or data
- Perform arithmetic and logical operators on high speed.

2.6 Registers

- ✓ Different registers are as follows:

1. Memory address register (MAR)
2. Memory Buffer Register (MBR)
3. Program Counter (PC)
4. Instructions Register
5. General Purpose Register
6. Address or Segment register
7. Stack Control Register
8. Flag Register

2.6 Registers

- ✓ Different registers are as follows:

1. Memory address register (MAR)

- ✓ Used to store memory address being used by CPU.
- ✓ CPU stores the address of memory location in this register in order to read or write data to it

2.6 Registers

- Different registers are as follows:

2. Memory Buffer Register (MBR)

- Used to store data coming from the memory or going to the memory.
- Act as a small memory buffer
- It ensures that processor and memory work without being affected by any difference in operation.

2.6 Registers

- Different registers are as follows:

3. Program Counter (PC)

- Used to control the sequencing of the executing of instructions.
- It stores the address of next instruction to fetched for execution.
- The value of program counter is loaded into memory address register that fetches the instruction from memory.

2.6 Registers

- Different registers are as follows:

4. Instructions Register (IR)

- Used to store the instructions that are fetched from memory for execution.
- An instruction register holds the instructions to be decoded by the control unit.
- The timing and control logic generate the sequence of signals to execute the instructions.

2.6 Registers

- Different registers are as follows:

5. General Purpose Register

- Used in mathematical and logical operations.
- These registers are part of ALU.

2.6 Registers

- ✓ Different registers are as follows:

6. Address or Segment Registers:

- ✓ Segment is a block of memory.
- ✓ Used to store the address of memory blocks of instructions being executed.

2.6 Registers

- Different registers are as follows:

7. Stack Control Register

- A stack is a memory location which data is stored and retrieved an order.
- This order is called Last-in-First-out (LIFO).
- Stack Control Registers are used to manage stack in computer.

2.6 Registers

- ✓ Different registers are as follows:

8. Flag Registers

- ✓ Used to indicate a particular condition.
- ✓ Size of flag register is one or two byte.
- ✓ Each byte is further divided into 8 bits.

2.7 Processor Cooling

- Proper cooling of Processor is very important.
- Excessive heat can damage a processor.
- Computer provides cooling system for the processor.
- Heat sink , cooling fans and liquid cooling system are used.

2.7 Processor Cooling

- Heat Sink is composed of metal or ceramic material and is attached to processor chip.
- It absorbs its heat and dissipates by the heat sink.
- Many heat sink also have fans to distribute the air dissipated by the heat sink.
- Heat sink without a fan is called Passive heat sink.
- Heat sink with a fan is called Active heat sink.

2.7 Processor Cooling

- Heat sink and cooling fans are normally installed above processor.
- A system unit has one or case fans to keep the entire system cool.
- Some computers also used liquid cooling system.
- It circulates liquid through tubes in the system to carry the heat away the processor.
- A cooling Pad can be used to further reduce the heat generated by the laptop.

2.7 Processor Cooling

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2.7 Processor Cooling

2.8 Coprocessor

- Special additional processor chip that helps main processor to perform specific task.
- Increases the performance of the computer.
- Known as floating point coprocessor or Math coprocessor.
- Improves the working of engineering, scientific and graphic applications.
- First seen on mainframe computers.
- Most of the computers used today also have coprocessors.

2.9 Parallel Processing

- A method uses multiple processors or multi core processors to speed up processing.
- These processors work simultaneously to complete program.
- Increases the performance of the computer.

2.9 Parallel Processing

- Divides a task into multiple smaller tasks
- Each processor solves the smaller task at the same time.
- Used in some personal computers with dual core or multi-core processors.
- Super computers uses parallel processing in complex applications like weather forecasting.

2.10 Comparison of Processors

- Most manufactures of processor chip are **Intel**, advanced Micro Devices (AMD), IBM and Motorola.
- The processors of these manufactures are normally identified by a model name or model number.

2.10 Comparison of Processors

- Intel is the world's largest chip manufacturer and supplies microprocessors for all types of computers.
- Introduced the first microprocessor in 1971 called 4004.
- Intel core family of processors are used in most high performance computers.
- Less expensive computers use the processor of Pentium or Celeron.
- Xeon and Itanium processors are used in workstation or server computers.
- Atom processors are used in tablets etc.

2.10 Comparison of Processors

- Advanced Micro Devices (AMD) is another popular processor manufacturer.
- Main competitors of Intel.
- Provides less expensive processors than Intel.
- Phenom are used in desktop and laptop.
- Opteron processor is used in servers and workstations.
- Fusion processor is used in tablets.

2.11 Benchmarking

- A technique used to test the overall speed of a microprocessor.
- The results of these tests are known as benchmark.
- The results of benchmarks are available on the web and published in computer magazines articles.
- Provides comparison of information for selecting or configuring computer systems.

2.11 Benchmarking

- Window 7 and 8 offer set of benchmarks called windows Experience index.
- It check a computer's performance and the performance of the components such as the processors, memory, graphics and storage system.