IT Fundamentals

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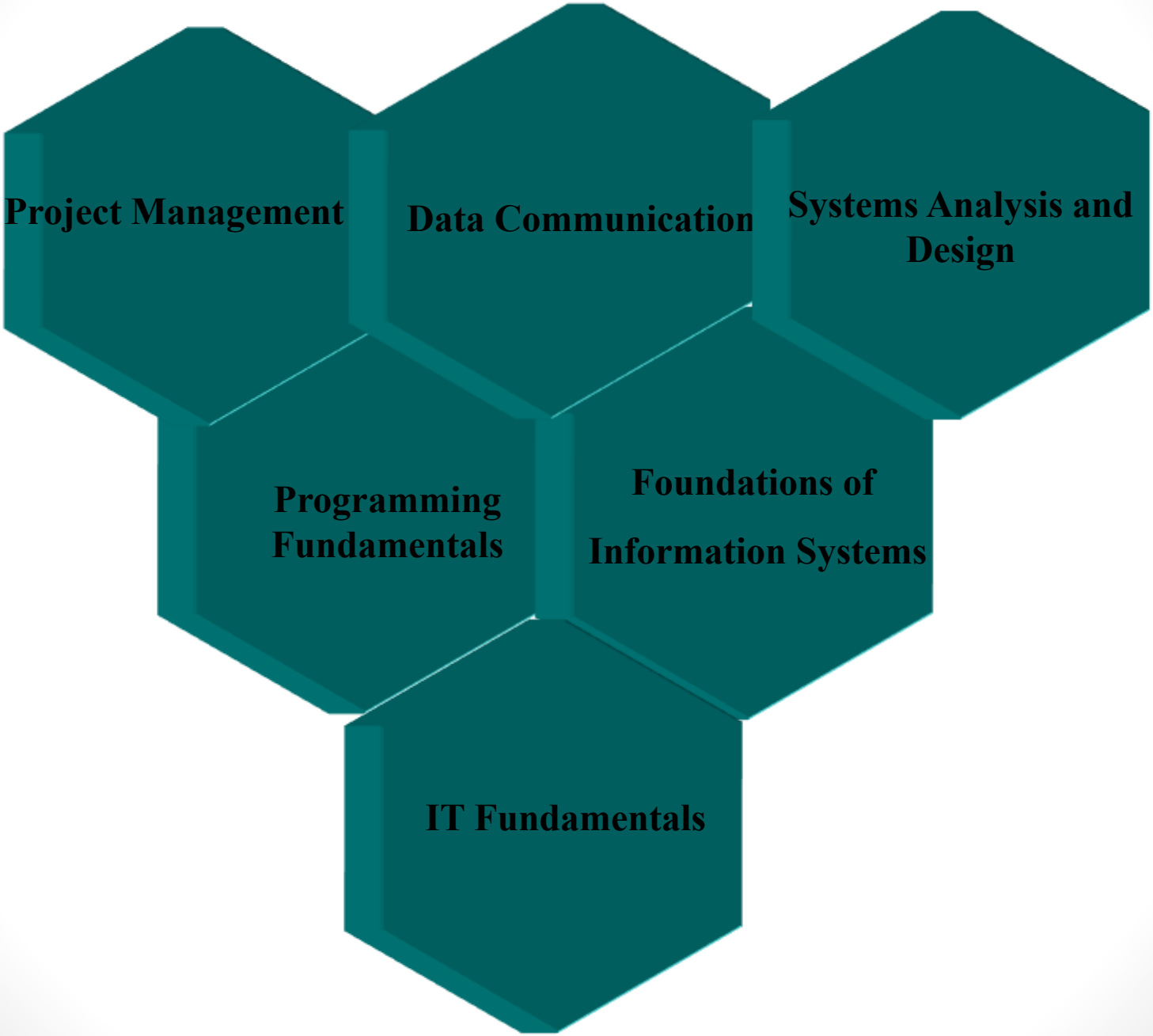
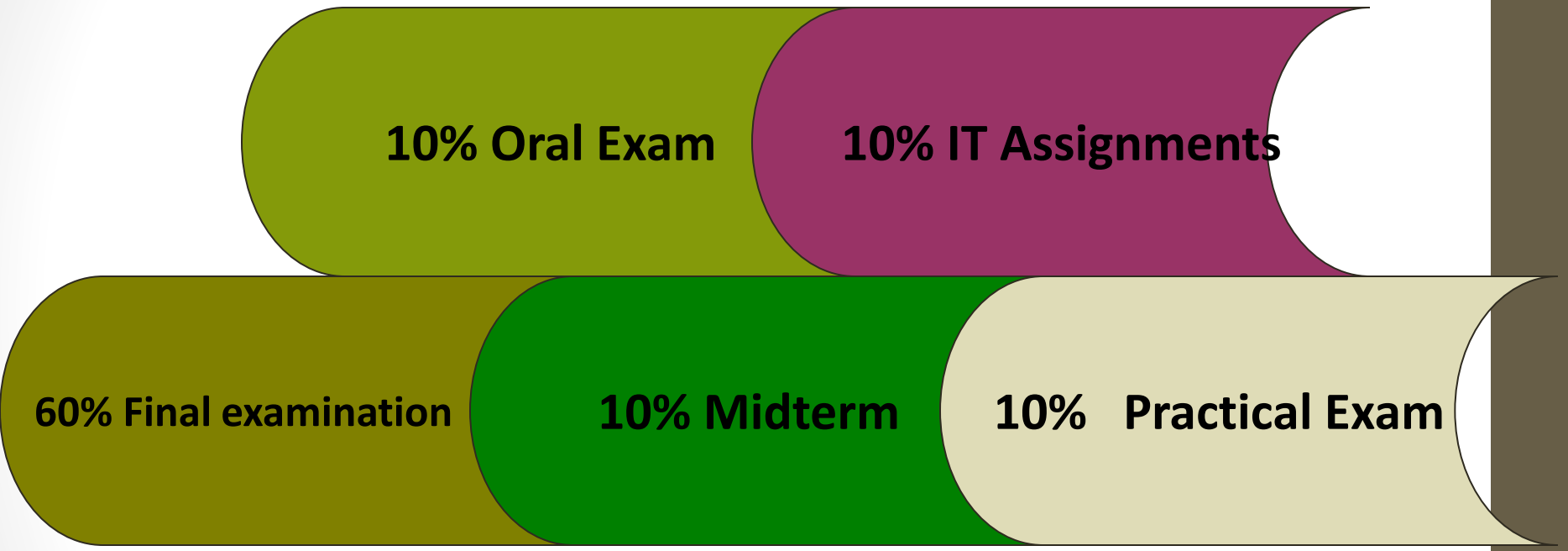
Example: CODE OF COURSES

IT	1	0	1	
				رقم المقرر
				رقم التخصص الفرعي
				رقم المستوى
				كود تخصص المقرر


Project Management
Data Communication
Systems Analysis and Design
Programming Fundamentals
Foundations of Information Systems
IT Fundamentals

Grading


10% Oral Exam
10% IT Assignments
60% Final examination
10% Midterm
10% Practical Exam

Outline

- Von Neumann architecture
- Machine level representation of data.
- Assembly level machine organization
- Hardware realizations of algorithms.
- Operating systems and virtual machines.
- Introduction to net-centric computing.

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- Von Neumann architecture
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Von Neumann architecture

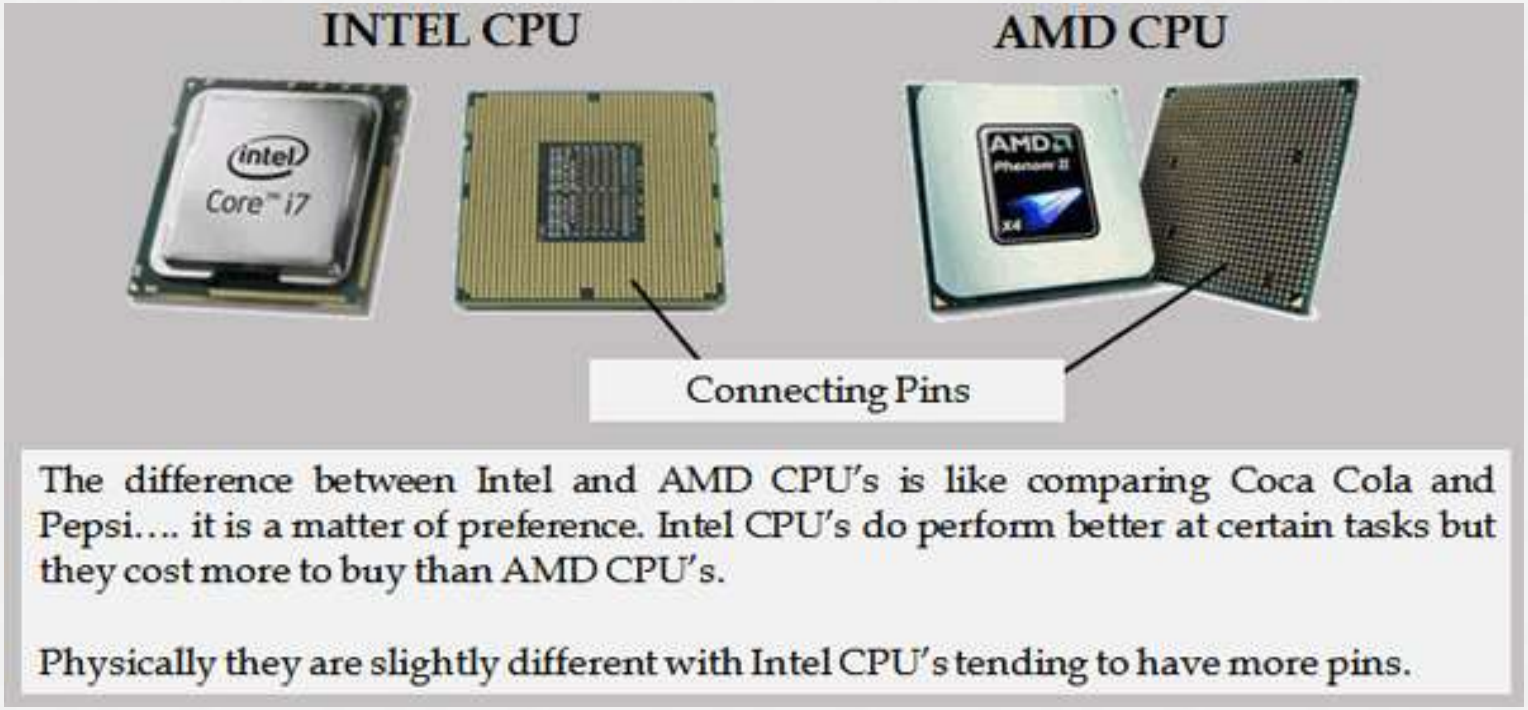
- 1. Central processing unit (CPU):
- • Arithmetic & logical unit (ALU).
- • Control Unit (CU).
- 2. Main Memory (MM)
- 3. Input/Output Units

1. Central Processing Unit

- The CPU **'controls'** what the computer does and is responsible for performing **calculations** and data **processing**. It also handles the **movement** of data to and from system memory.
- CPU's come in a variety of speeds which are known as **'clock rates'**. Clock rates are measured in 'Hertz'. Generally, the faster the clock rate, the faster the performance of the computer.

1. Central Processing Unit

- There are two main brands of CPU currently on the market... AMD and Intel.



The difference between Intel and AMD CPU's is like comparing Coca Cola and Pepsi…. it is a matter of preference. Intel CPU's do perform better at certain tasks but they cost more to buy than AMD CPU's.

Physically they are slightly different with Intel CPU's tending to have more pins.

Buses

- The CPU is connected with memory by Buses consisting of a set of lines (wires).
- Buses: are defined as a set of wires connecting various computer units to pass and exchange information between these units. Can be classified by:
- *1. Data transfer mode:*
- *2. According to the nature of the data:*

Buses

- *1. Data transfer mode:*
- • Serial Buses: where **one wire** is needed to transfer the data so that it is transmitted **bit by bit**.
- • Parallel Buses: where a number of wires are required to equal the **number of places of the word** to be passed so that these cells **move simultaneously** and in parallel.
- *2. According to the nature of the data:*
- Divided into three types: Data bus, Address bus: Control bus.

Bus nature of data

- • **Data bus**: is the set of lines allocated for the *exchange and transfer of* ***information*** and data between the CPU and the main memory, and the transfer of data in **both directions** from the CPU to memory and vice versa.
- • **Address bus**: A set of lines assigned to transfer *addresses* from the CPU to memory and moving addresses ***one-way*** from the *CPU to memory*.

Bus nature of data

- • **Control bus**: is a set of lines allocated to transfer *control signals* between the CPU and memory and the transmission of control signals in ***one direction from CPU***.

1. Central Processing Unit

- 1.1 Arithmetic & logical unit (ALU).
- 1.2 Control Unit (CU).

Arithmetic & Logical Unit (ALU)

- An arithmetic-Logic Unit (ALU) is the part of a computer processor (CPU) that carries out arithmetic and logic operations on the operands in computer instruction words.
- In some processors, the ALU is divided into two units, an Arithmetic Unit (AU) and a Logic Unit (LU).

Arithmetic & Logical Unit (ALU)

- The **input** consists of an **instruction word** (sometimes called a machine instruction word) that contains an operation code (sometimes called an "**op code**"), one or more **operands**, and sometimes a format code.
- The **operation** code tells the ALU **what** operation to **perform** and the **operands** are **used in** the operation.
- ALU includes **storage places** for **input operands**,

Arithmetic & Logical Unit (ALU)

- Some processors contain **more** than one AU - for example, one for *fixed-point operations* and another for *floating-point operations*.
- ALU directs input and output access to the **processor controller**, main memory (random access memory or RAM in a personal computer), and input/output devices.
- Inputs and outputs flow along an electronic path that is called a **bus**.

Control Unit (CU):

- Before an instruction can be **executed**, program **instructions** and **data** must be placed into **memory** from an input device or a secondary storage device
- The Control Unit performs the following four steps for each instruction:
- 1. The control unit **fetches** (gets) the instruction from memory.

Control Unit (CU)

- 2. The Control Unit **decodes** the instruction (decides what it means) and directs that the necessary data be moved from memory to the CU unit. These first two steps together are called **instruction time**, or **I-time**.
- 3. The Control Unit unit **executes** the arithmetic or logical instruction. That is, the ALU is given control and performs the actual operation on the data.
- 4. The Control Unit **stores** the result of this operation in memory or in a register. Steps 3 and 4 together are called **execution time**, or E-time.

Control Unit (CU)

- The control unit eventually directs memory to release the result to an output device or a secondary storage device. The **combination** of I-time and E-time is called the **machine cycle**.
- Each **central processing unit** has an **internal clock** that produces **pulses** at a **fixed rate** to **synchronize** all computer operations.

Control Unit (CU)

- A *single* ***machine-cycle instruction*** may be made up of a substantial number of ***sub-instructions***, **each** of which must take at least *one clock cycle*.
- Each **type** of central processing unit is designed to understand a **specific** group of instructions called the *instruction set*.
- Therefore, one **CPU**-such as the one for a **Compaq** personal computer-**cannot understand** the instruction set from another CPU-say, for a **Macintosh**.

Clock Speed

- is the **rate** at which a processor can **complete** a processing cycle.
- It is typically measured in **megahertz** or **gigahertz**.
- One megahertz is equal to **one million cycles** per second, while one gigahertz equals one billion cycles per second.
- This means a 1.8 GHz processor has twice the clock speed of a 900 MHz processor.

Clock Speed

- However, it is important to note that a 1.8 GHz CPU is not necessarily **twice as fast** as a 900 MHz CPU.
- This is because different processors often use different **architectures**.
- For example, one processor may require *more clock cycles to complete* a multiplication instruction than another processor.
- If the 1.8 GHz CPU can complete a multiplication instruction in 4 cycles, while the 900 MHz CPU takes 6 cycles,

Clock Speed

- the 1.8 GHz processor will perform the operation more than twice as fast as the 900 MHz processor.
- Conversely, if the 1.8 GHz processor *takes more cycles to perform the same instruction*, it will be less than 2x as fast as the 900 MHz processor.
- ***Other factors*** also contribute to the overall performance of a computer. Examples include the **number** of processors, the bus **speed**, cache **size**, speed of the **RAM**, and HDD or SSD speed.

Clock Speed

- Therefore, while the processor's clock speed is a *significant indicator* of how fast a computer is, it is not the only factor that matters.

Main Memory

Main Memory

- Computer memory can be classified in the below given hierarchy:
- 1) Internal register.
- 2) Cache
- 3) RAM (Random Access Memory)
- 4) Hard disk
- 5) Magnetic tape

Internal register

- Registers are **temporary storage** areas for instructions or data.
- They are **not a part of memory**; rather they are special additional storage locations that **offer** the advantage of speed.
- Registers work **under** the direction of the **control unit** to accept, hold, and transfer **instructions** or **data** and **perform** arithmetic or logical comparisons at **high speed**.

Internal register

- Computers usually assign **special roles** to **certain registers**:
- **Accumulator**, which collects the ***result*** of computations.
- **Address register**, which keeps track of ***where*** a given instruction or piece of data is ***stored*** in memory. Each storage *location* in memory is identified by an ***address***.
- **A storage register**, which *temporarily holds data* taken from or about to be *sent* to memory.
- **General-purpose register**, is used for several functions.

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Cache

- is used by the CPU for memory which is being **accessed over and over again**. Instead of pulling it every time from the main memory, it is put in cache for fast access. It is also a smaller memory, however, larger than internal register.
- Common types of caches include:
- Processor cache: is further classified to L1, L2 and L3:
- a) L1 cache: It is accessed without any delay.
- b) L2 cache: It takes more clock cycles to access than L1 cache.
- c) L3 cache: It takes more clock cycles to access than L2 cache.

Cache

- **Browser cache**: Most web browsers **cache** webpage **data** by default. For example, when you **visit** a webpage, the **browser** may **cache** the HTML, images, and any CSS or JavaScript files referenced by the page. When you browse through other pages on the site that **use the same** images, **CSS**, or **JavaScript**, your browser will **not** have to **re-download the files**. Instead, the browser can simply **load** them from the **cache**, which is stored on your local hard drive.

Cache

- **Memory cache -** When an application is **running**, it may cache **certain data** in the **system memory**, or RAM.

Main Memory

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- 5) Magnetic tape

RAM

- **3) Main memory or RAM (Random Access Memory):**
- It is a **type** of the computer memory and is a hardware component.
- It **can be increased** provided the operating system can **handle** it.
- Typical PCs these days use 8 GB of RAM. It is **accessed slowly** as **compared** to **cache**.

Main Memory

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- 1) Internal register.
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Hard disk

- **4) Hard disk:** A hard disk is a hardware component in a computer.
- Data is kept *permanently* in this memory.
- Memory from hard disk is **not *directly*** *accessed* by the CPU, hence it is slower.
- As compared with RAM, hard disk is **cheaper *per bit***.

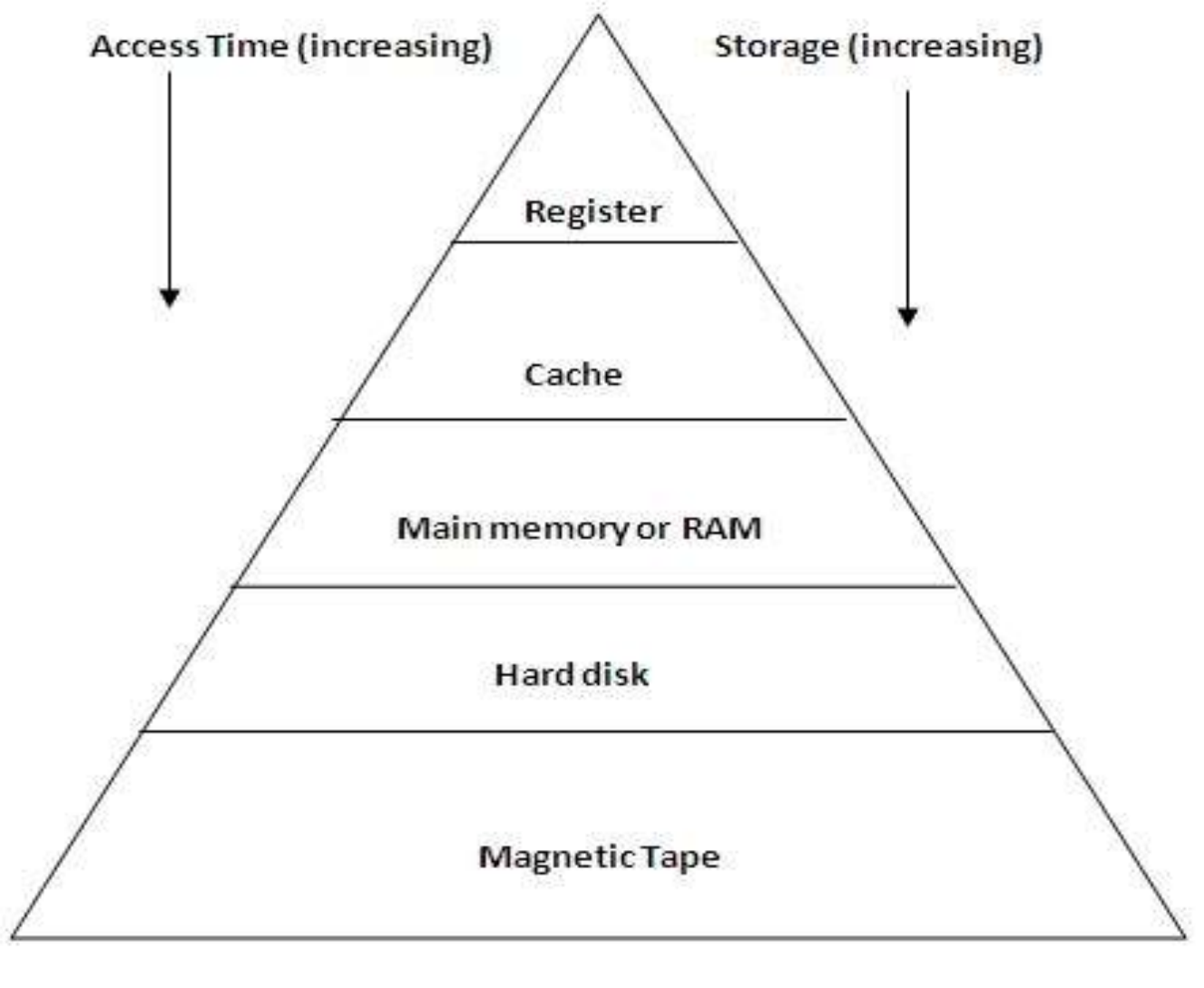
Main Memory

- Computer memory can be classified in the below given hierarchy:
- 1) Internal register.
- 2) Cache
- 3) RAM (Random Access Memory)
- 4) Hard disk
- 5) Magnetic tape

Magnetic tape

- **5) Magnetic tape:** Magnetic tape memory is usually used for ***backing up*** *large data*.
- When the **system** needs to **access** a **tape**, it is first **mounted** to access the data. When the data is **accessed**, it is then **unmounted**.
- The memory **access time** is *slower* in magnetic tape and it usually **takes few minutes** to **access** a tape.

Main Memory


Access Time (increasing)
Storage (increasing)
Register
Cache
Main memory or RAM
Hard disk
Magnetic Tape


End


Thank You