

Introduction To Information Technology

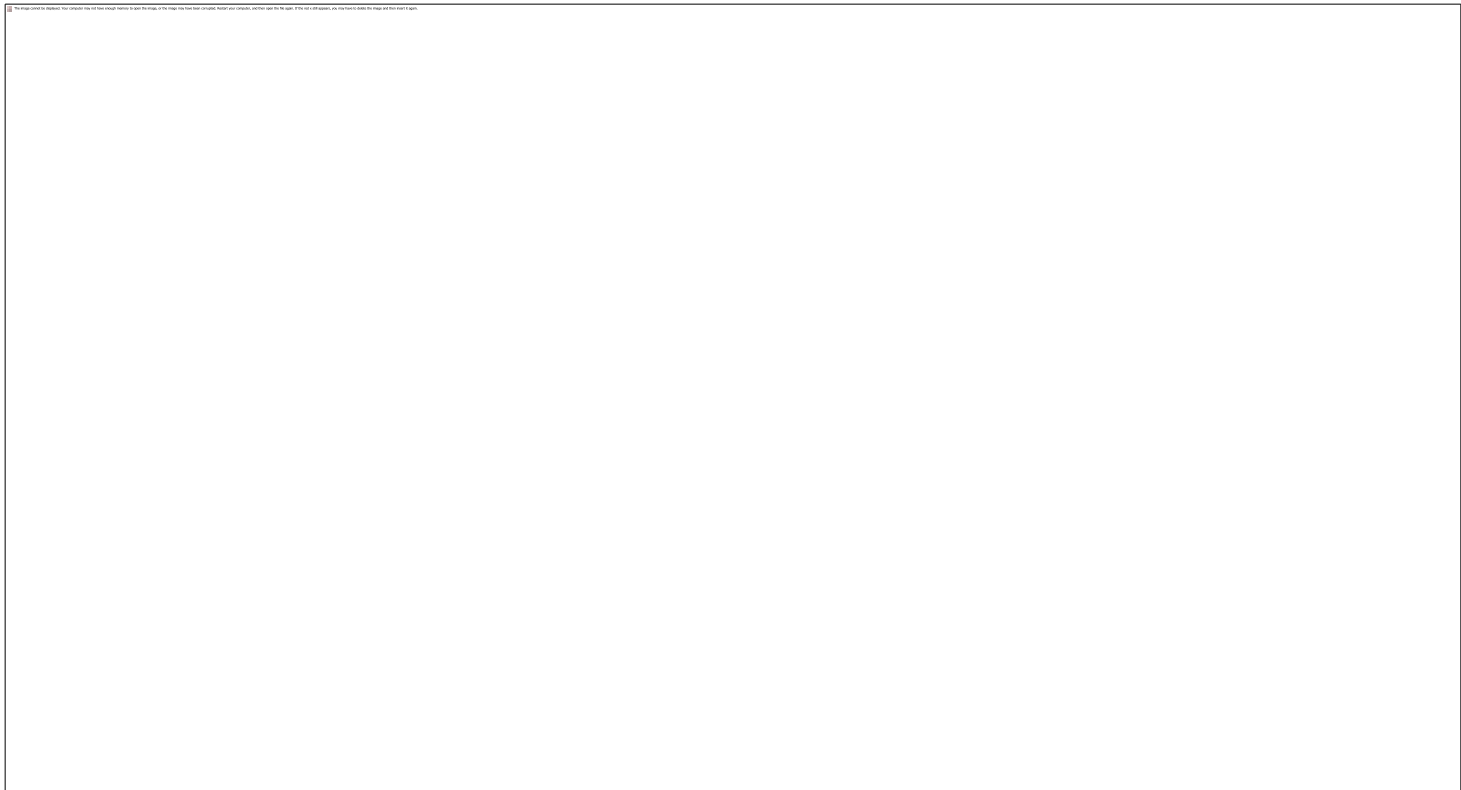
Lecture # 1

Definition of Information Technology

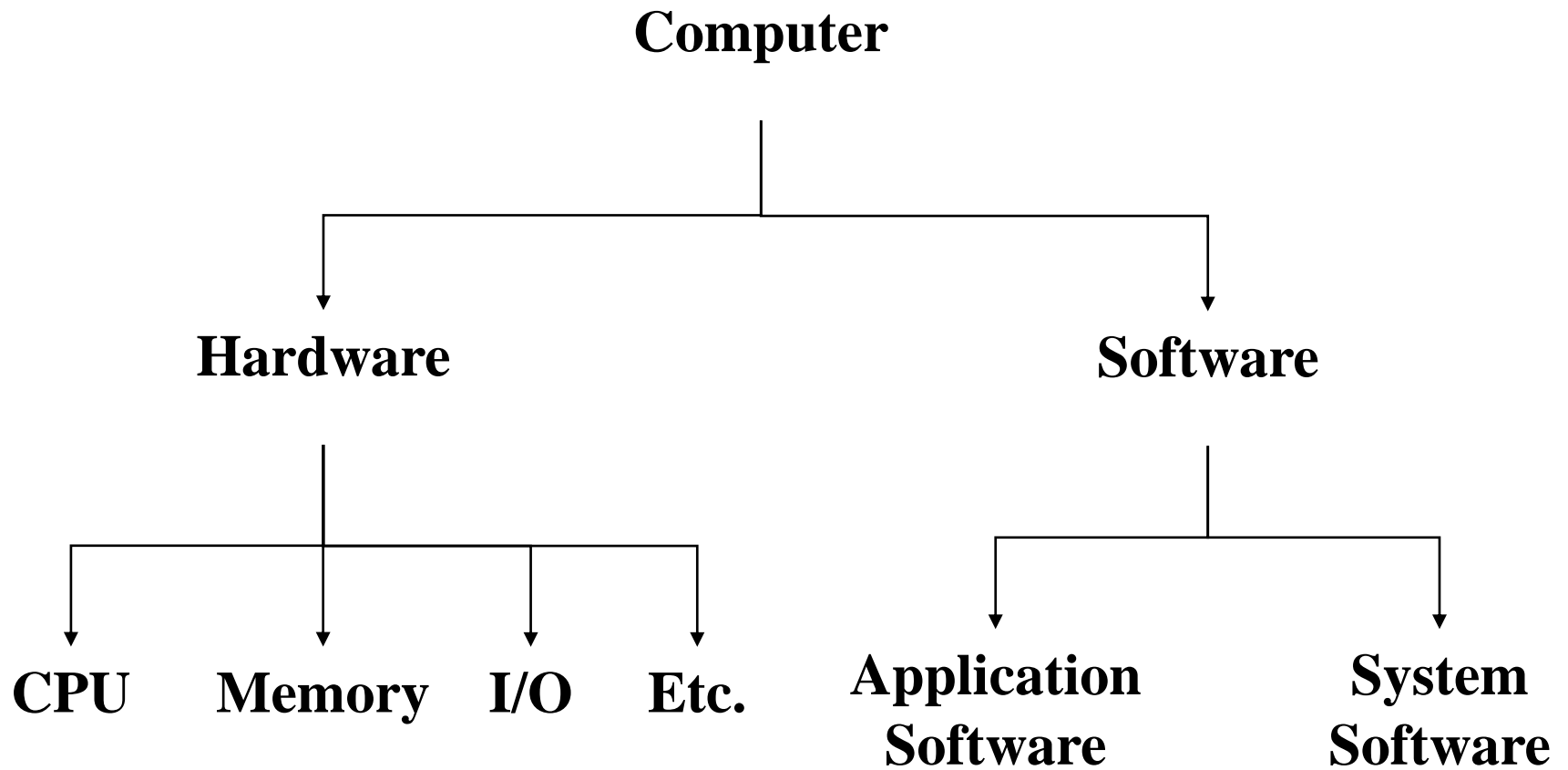
- Information technology is the technology that uses computing with high speed communication links to spread information from one place to another.
- Computer is a very important component of information technology
- The world has become “global village” due to advancement in IT.

What is a Computer?

- An electronic device that is programmed to accept data, process data into useful information and store it for later use
- Computer consists of hardware and software
- Software is a set of instructions that tells a computer what to do
- Hardware is the physical part of a computer
E.g. keyboard , mouse etc
- Relationship between hardware and software



Few Basics



Types of Computers

- Analog computers
- Digital computers

Analog Computers

- An analog computer recognizes data as a continuous measurement of a physical property.
- It has no state
- Its output is usually displayed on a meter or graphs.
- Examples are Analog clock, speed of a car, thermometer etc



Digital Computers

- It works with numbers
- They breaks all types of information into tiny units and use numbers to represent those pieces of information.
- Everything is described in two states i.e. either ON (1) or OFF (0).
- They are very fast and have big memory

History and Generations of computers

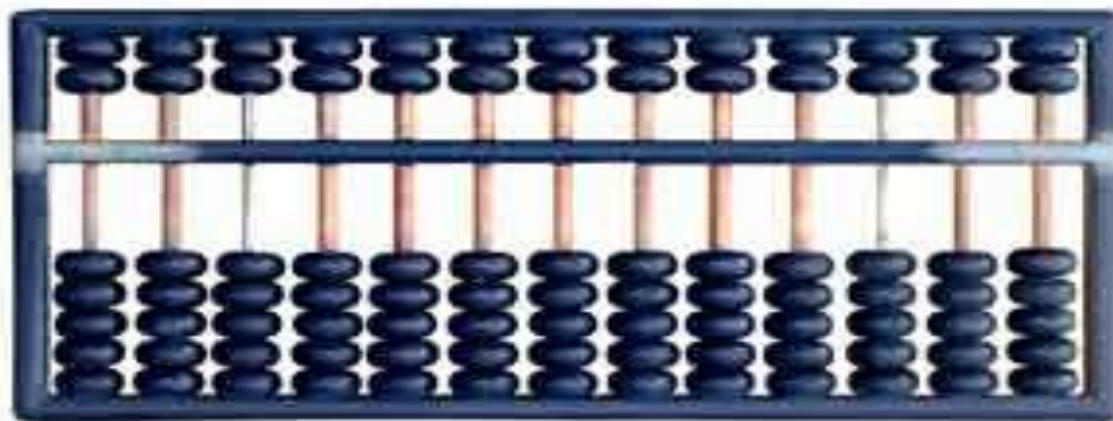
The six generations of computers are:

- Mechanical era(1623-1900)
- First generation electronic computers(1937-1953)
- Second generation (1954-1962)
- Third generation (1963-1972)
- Forth generation (1972-1984)
- Fifth generation (1984-1990)
- Sixth generation (1990 - present)

Mechanical Era

- Abacus (3000 BC)

It was used to perform addition, subtraction, division and multiplication. It consists of wooden beads and calculation were performed by moving these beads properly.



- Napier's bone (17th century)

It was a cupboard multiplication calculator invented by John Napier.

It was used to perform difficult multiplication operations to simple addition of entries in a table

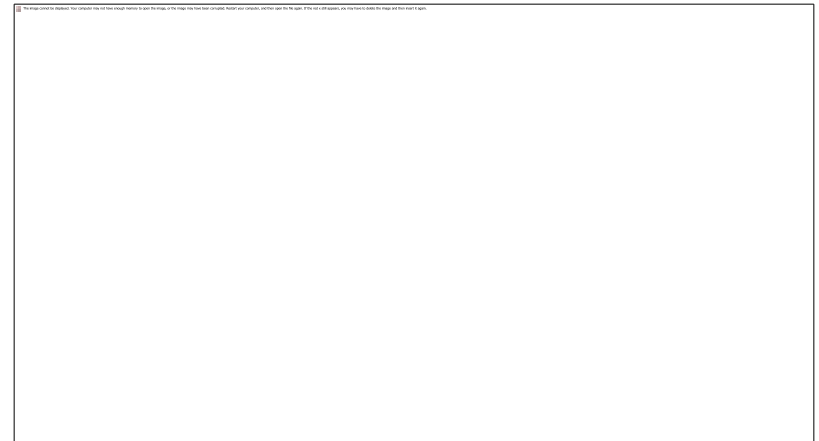


- Pascaline (17th century)

It was invented by Blaise Pascal.

It was first mechanical adding machine

It had a series of wheels with teeth which could be turned using hands.



- Difference Engine and Analytical Engine(1823 and 1833)

It was designed by Charles Babbage who was English mathematician, engineer, philosopher and inventor.

He originated the concept of the programmable computer.

A general purpose computer controlled by a list of instructions

- Punched cards (1890)

They were able to read information that which have been punched into the cards automatically

First generation Electronic computers

- First generation computers were used during 1942-1955 .
- They were based on **Vacuum Tube** which was a glass (tube) that controlled and amplified the electronic signals
- Consume more power with limited performance
- High cost
- Uses assembly language – to prepare programs. These were translated into machine level language for execution



- Fixed point arithmetic was used
- 100 to 1000 fold increase in speed relative to the earlier mechanical and relay based electromechanical technology
- Punched cards and paper tape were invented to feed programs and data and to get results.
- Magnetic tape / magnetic drum were used as secondary memory
- Mainly used for scientific computations.
- See page # 6, Table 1A.2
- Examples are: UNIVAC, Harvard Mark 1, ENIAC etc

Generation (Period)	Key hardware technologies	Key software technologies	Key characteristics	Some representative systems
First (1942-1955)	<ul style="list-style-type: none"> ▪ Vacuum tubes ▪ Electromagnetic relay memory ▪ Punched cards secondary storage 	<ul style="list-style-type: none"> ▪ Machine and assembly languages ▪ Stored program concept ▪ Mostly scientific applications 	<ul style="list-style-type: none"> ▪ Bulky in size ▪ Highly unreliable ▪ Limited commercial use and costly ▪ Difficult commercial production ▪ Difficult to use 	<ul style="list-style-type: none"> ▪ ENIAC ▪ EDVAC ▪ EDSAC ▪ UNIVAC I ▪ IBM 701

Second Generation (1955-1964)

- Bell Lab invented the transistor – function like vacuum tubes but smaller, lower power consumption, more reliable.
- Transistor is a small device that transfer electronic signals across a resistor
- Lower cost
- Magnetic core memories were used as main memory which is a random-access nonvolatile memory
- Magnetic tapes and magnetic disks were used as secondary memory
- Hardware for floating point arithmetic operations was developed.

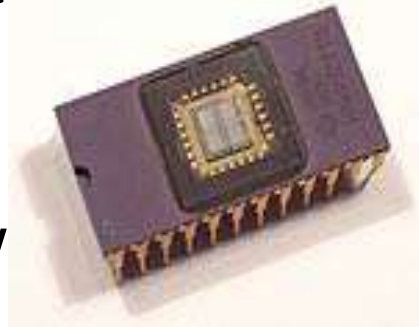


- Index registers were introduced which increased flexibility of programming.
- High level languages such as FORTRAN, COBOL etc were used - Compilers were developed to translate the high-level program into corresponding assembly language program which was then translated into machine language.
- Separate input-output processors were developed that could operate in parallel with CPU.
- Punched cards continued during this period also.
- 1000 fold increase in speed.
- See Page# 6 , Table 1A.3
- Examples are: TRADIC, IBM 704, LARC etc

Generation (Period)	Key hardware technologies	Key software technologies	Key characteristics	Some representative systems
Second (1955-1964)	<ul style="list-style-type: none"> ▪ Transistors ▪ Magnetic cores memory ▪ Magnetic tapes ▪ Disks for secondary storage 	<ul style="list-style-type: none"> ▪ Batch operating system ▪ High-level programming languages ▪ Scientific and commercial applications 	<ul style="list-style-type: none"> ▪ Faster, smaller, more reliable and easier to program than previous generation systems ▪ Commercial production was still difficult and costly 	<ul style="list-style-type: none"> ▪ Honeywell 400 ▪ IBM 7030 ▪ CDC 1604 ▪ UNIVAC LARC

Third Generation (1963-1971)

- Jack Kilby developed **Integrated Circuit (IC)**
- An IC combined several electronic components on a small silicon chip
- IBM introduced System/360 – a highly configurable, highly backward compatible, **mainframe** computer system.
- Small Scale Integration and Medium Scale Integration technology were implemented in CPU, I/O processors etc.
- Smaller & better performance
- Comparatively lesser cost
- Faster processors



- In the beginning magnetic core memories were used. Later they were replaced by semiconductor memories (RAM & ROM)
- Introduced microprogramming
- Microprogramming, parallel processing (pipelining, multiprocessor system etc), multiprogramming, multi-user system (time shared system) etc were introduced.
- Operating system software were introduced
- Cache and virtual memories were introduced

- High level languages were standardized by ANSI e.g.. ANSI FORTRAN, ANSI COBOL etc
- Database management, multi-user application, online systems like closed loop process control, airline reservation, interactive query systems, automatic industrial control etc emerged during this period.
- See page # 7, Table 1A.4
- Examples are: INTEL 4004, IBM SYSTEM/360 etc

Generation (Period)	Key hardware technologies	Key software technologies	Key characteristics	Some rep. systems
Third (1964-1975)	<ul style="list-style-type: none"> ▪ ICs with SSI and MSI technologies ▪ Larger magnetic cores memory ▪ Larger capacity disks and magnetic tapes secondary storage ▪ Minicomputers; upward compatible family of computers 	<ul style="list-style-type: none"> ▪ Timesharing operating system ▪ Standardization of high-level programming languages ▪ Unbundling of software from hardware 	<ul style="list-style-type: none"> ▪ Faster, smaller, more reliable, easier and cheaper to produce ▪ Commercially, easier to use, and easier to upgrade than previous generation systems ▪ Scientific, commercial and interactive on-line applications 	<ul style="list-style-type: none"> ▪ IBM 360/370 ▪ PDP-8 ▪ PDP-11 ▪ CDC 6600

Forth generation (1972-1984)

- Microprocessors were introduced as CPU— Complete processors and large section of main memory could be implemented in a single chip
- Tens of thousands of transistors can be placed in a single chip (VLSI design implemented)
- CRT screen, laser & ink jet printers, scanners etc were developed.
- Semiconductor memory chips were used as the main memory.
- Secondary memory was composed of hard disks – Floppy disks & magnetic tapes were used for backup memory

- Parallelism, pipelining cache memory and virtual memory were applied in a better way
- LAN and WANS were developed (where desktop work stations interconnected)
- Introduced C language and Unix OS
- Introduced Graphical User Interface
- Less power consumption
- High performance, lower cost and very compact
- Much increase in the speed of operation
- Examples are Apple Macintosh and IBM PC
- See Page # 7, Table 1A.5

Generation (Period)	Key hardware Technologies	Key software technologies	Key characteristics	Some rep. systems
Fourth (1975-1989)	<ul style="list-style-type: none"> ▪ ICs with VLSI technology ▪ Microprocessors; semiconductor memory ▪ Larger capacity hard disks as in-built secondary storage ▪ Magnetic tapes and floppy disks as portable storage media ▪ Personal computers ▪ Supercomputers based on parallel vector processing and symmetric multiprocessing technologies ▪ Spread of high-speed computer networks 	<ul style="list-style-type: none"> ▪ Operating systems for PCs with GUI and multiple windows on a single terminal screen ▪ Multiprocessing OS with concurrent programming languages ▪ UNIX operating system with C programming language ▪ Object-oriented design and programming ▪ PC, Network-based, and supercomputing applications 	<ul style="list-style-type: none"> ▪ Small, affordable, reliable, and easy to use PCs ▪ More powerful and reliable mainframe systems and supercomputers ▪ Totally general purpose machines ▪ Easier to produce commercially ▪ Easier to upgrade ▪ Rapid software development possible 	<ul style="list-style-type: none"> ▪ IBM PC and its clones ▪ Apple II ▪ TRS-80 ▪ VAX 9000 ▪ CRAY-1 ▪ CRAY-2 ▪ CRAY-X/MP

Fifth Generation (1983-1990)

- Computers based on artificial intelligence are available
- Computers use extensive parallel processing, multiple pipelines, multiple processors etc
- Massive parallel machines and extensively distributed system connected by communication networks fall in this category.
- Introduced ULSI (Ultra Large Scale Integration) technology – Intel's Pentium 4 microprocessor contains 55 million transistors millions of components on a single IC chip.
- Superscalar processors, Vector processors, SIMD processors, 32 bit micro controllers and embedded processors, Digital Signal Processors (DSP) etc have been developed.
- Memory chips up to 1 GB, hard disk drives up to 180 GB and optical disks up to 27 GB are available (still the capacity is increasing)
- Object oriented language like JAVA suitable for internet programming has been developed.

- Portable note book computers introduced
- Storage technology advanced – large main memory and disk storage available
- Introduced World Wide Web. (and other existing applications like e-mail, e Commerce, Virtual libraries/Classrooms, multimedia applications etc.)
- New operating systems developed – Windows 95/98/XP/..., LINUX, etc.

- Got hot pluggable features – which enable a failed component to be replaced with a new one without the need to shutdown the system, allowing the uptime of the system to be very high.
- The recent development in the application of internet is the Grid technology which is still in its upcoming stage.
- See Page # 8, Table 1A.6

Generation (Period)	Key hardware technologies	Key software technologies	Key characteristics	Some rep. systems
Fifth (1989-Present)	<ul style="list-style-type: none"> ▪ ICs with ULSI technology ▪ Larger capacity main memory, hard disks with RAID support ▪ Optical disks as portable read-only storage media ▪ Notebooks, powerful desktop PCs and workstations ▪ Powerful servers, supercomputers ▪ Internet ▪ Cluster computing 	<ul style="list-style-type: none"> ▪ Micro-kernel based, multithreading, distributed OS ▪ Parallel programming libraries like MPI & PVM ▪ JAVA ▪ World Wide Web ▪ Multimedia, Internet applications ▪ More complex supercomputing applications 	<ul style="list-style-type: none"> ▪ Portable computers ▪ Powerful, cheaper, reliable, and easier to use desktop machines ▪ Powerful supercomputers ▪ High uptime due to hot-pluggable components ▪ Totally general purpose machines ▪ Easier to produce commercially, easier to upgrade ▪ Rapid software development possible 	<ul style="list-style-type: none"> ▪ IBM notebooks ▪ Pentium PCs ▪ SUN Workstations ▪ IBM SP/2 ▪ SGI Origin 2000 ▪ PARAM 10000

Sixth Generation Computers(1990-till date)

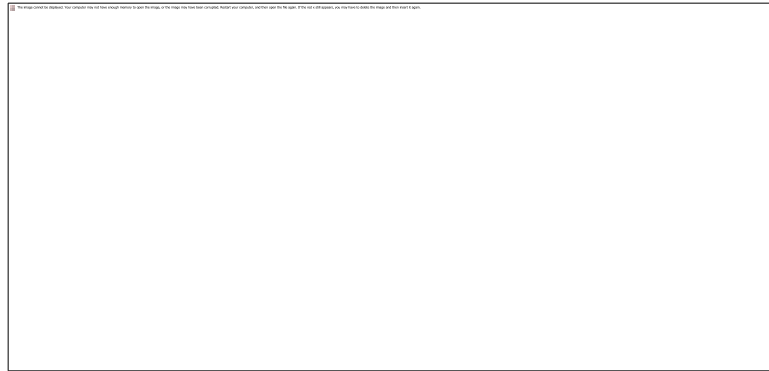
- Some inventions of the time are WWW, HTML, HTTP, Web TV, java, DVD, iPod, Youtube etc
- See Page # 8 , Table 1A.7
- Examples are: iMac , Sun ultra workstation etc

Computers Systems and its Components

- Input Devices
- Output devices
- System Unit
- Storage devices
- Communication devices

Input devices

- The devices that are used to enter data and instructions into the computers
- Most commonly used input devices are Keyboard and Mouse



Output Devices

- Output devices are used to display processed data to the user
- Most commonly used output devices are Monitor, Printer and speakers
- Hard Copy is paper copy – tangible
- Soft copy is intangible



Lexmark Z605 Inkjet Printer



<http://www.computerhope.com>

System Unit

- Its a box that contains different components of a computer system.
- All electronic components in the system unit are connected to motherboard
- Important components of system units are:
 - Central processing Unit(Processor)
 - Memory

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Storage Devices

- These are used to store data permanently even when the computer is turned off
- It is non volatile memory
- Examples:
Floppy Disk, Hard disk, CD ROM



Communication devices

- A communication device is a hardware component that enables a computer to send and receive data, instructions and information to and from one or more computers.
- A widely used communication device is a Modem
- Wired media
- Wireless media



Modulation and Demodulation

- Modulation

Conversion from Digital signals to Analog signals

- Demodulation

Conversion from Analog signals to Digital signals



Computers in society

- Home
- Education
- Small business
- Industry
- Government
- Health care
- Banking
- Communication
- Police Department
- Retail

Information Processing cycle

- Data

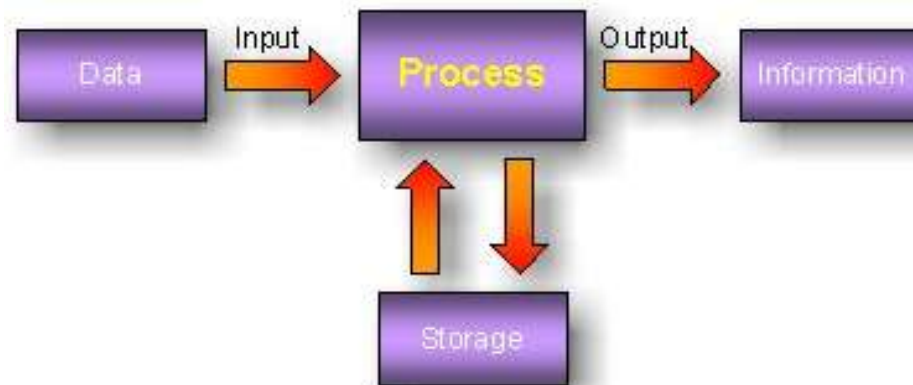
A collection of raw facts and figures is called data. It may consist of numbers, characters, symbols or pictures etc

- Information

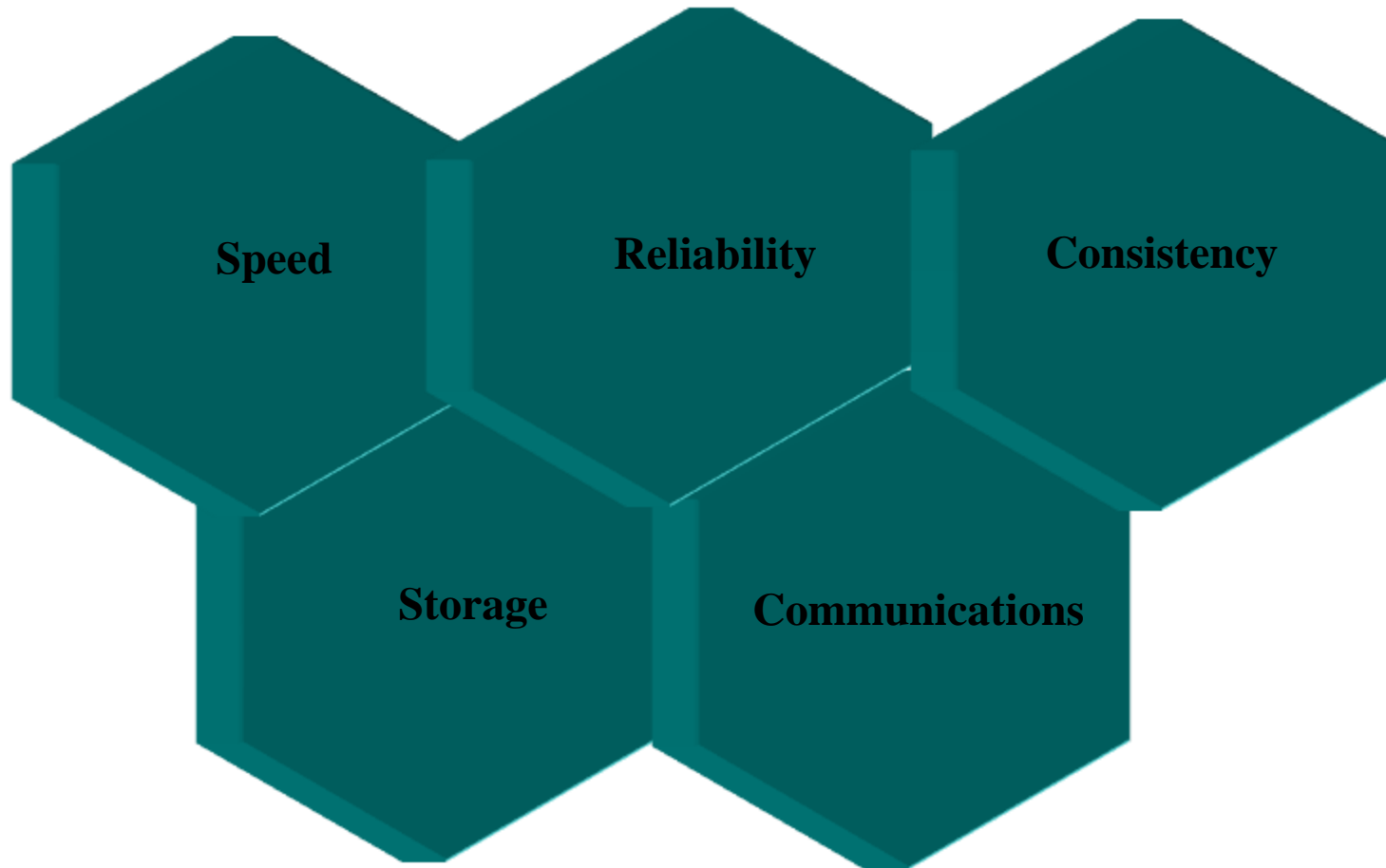
Processed data is called information. It is more meaningful than data.

Information Processing Cycle

- Data is collected and given to the computer for processing
- Computer process data to the required information
- The information is given to the user as output
- Information is stored in the computer for further use



Advantages of computers



Disadvantages of computers

