Introduction to Informational and Communication Technologies

Lecture # 1

- Information and communication technologies (ICT) is the discipline which considers modern methods and means of communication of people in a normal and professional activities with the help of information technologies to search , collection, storage , processing and dissemination of information.

INTERNATIONAL IT UNIVERSITY

Thematic plan

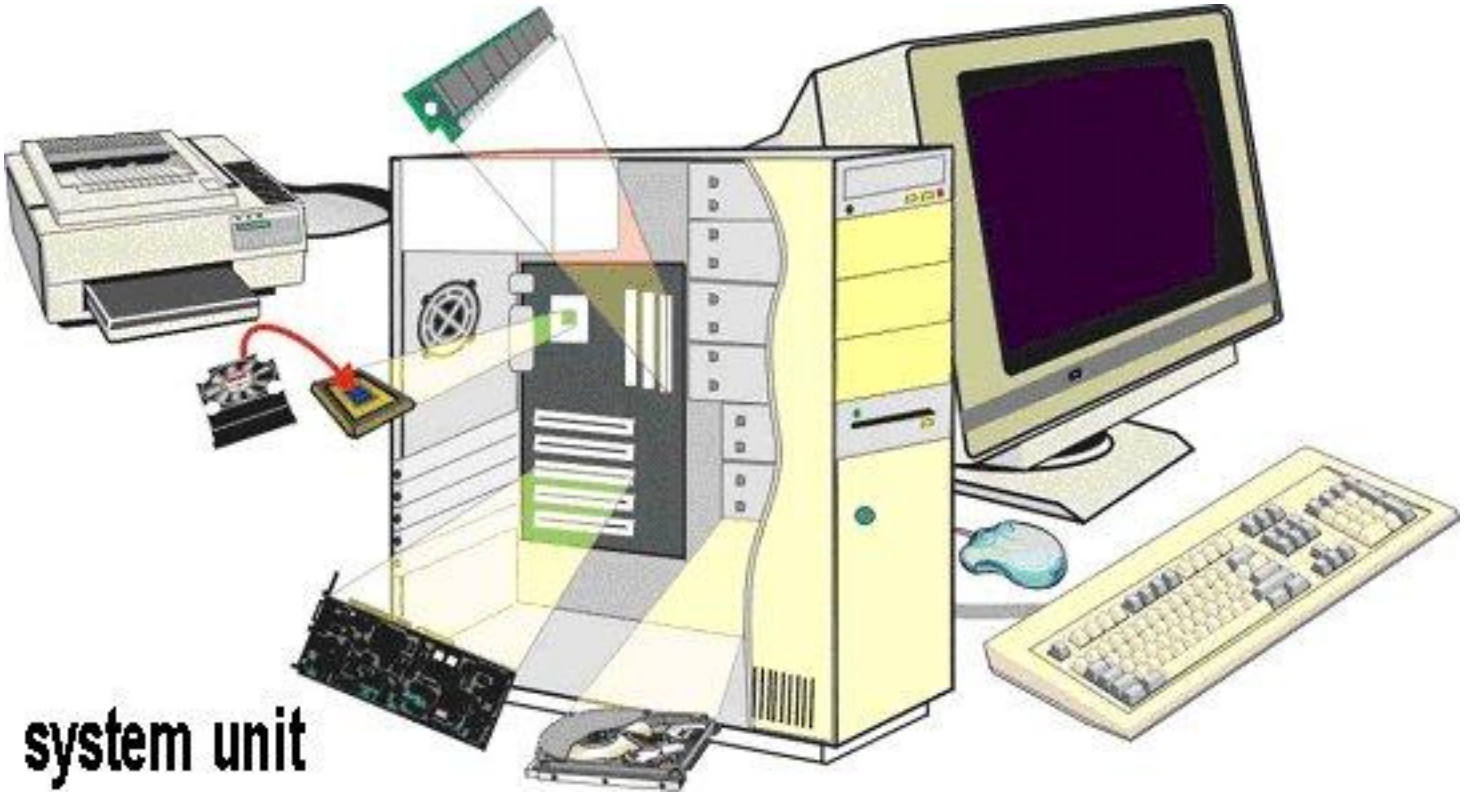
№	Titles of lectures
1	Main directions of ICT development . ICT Standardization
2	Operation systems
3	Text processors and editors
4	Electronic tables
5	Database management systems
6	Local area network
7	Global networks
8	Social networks
9	Privacy and information security in ICT
10	Introduction to Web-technology
11	Tools for graphical representation of the information
12	Human-machine interaction
13	Multimedia technologies
14	SMART-тtechnologies
15	E-technologies and the prospects of the ICT development

Definition of Information Technology

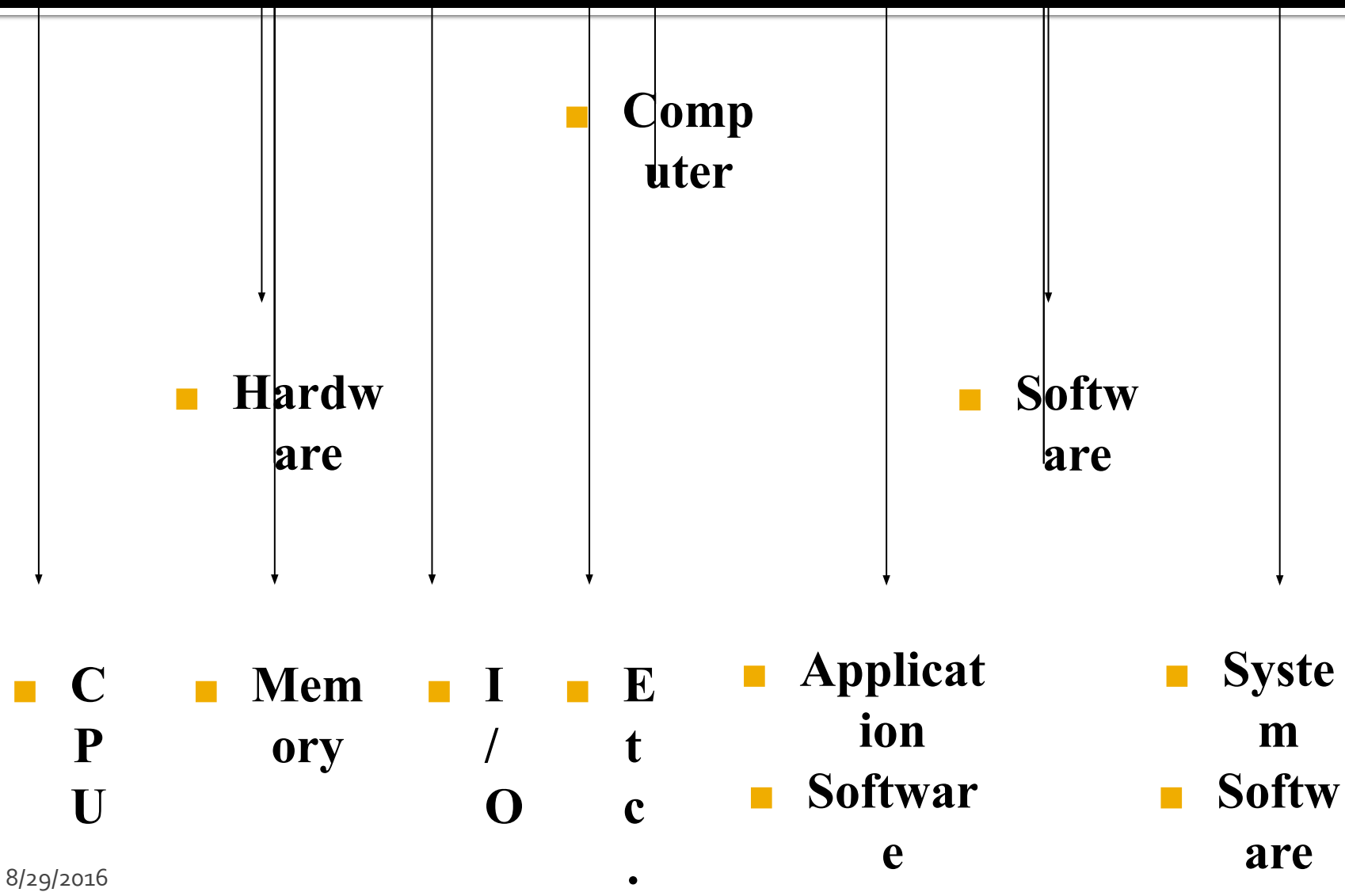
- Information technology is the technology that uses computing with high speed communication links to spread information from one place to another.
- Computer is a very important component of information technology
- The world has become "global village" due to advancement in IT.

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. CPU, RAM, HDD.etc
- Relationship between hardware and software


system unit

Few Basics


Computer
Hardware
Software
CPU
Memory
I/O
Etc.
Application Software
System Software

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

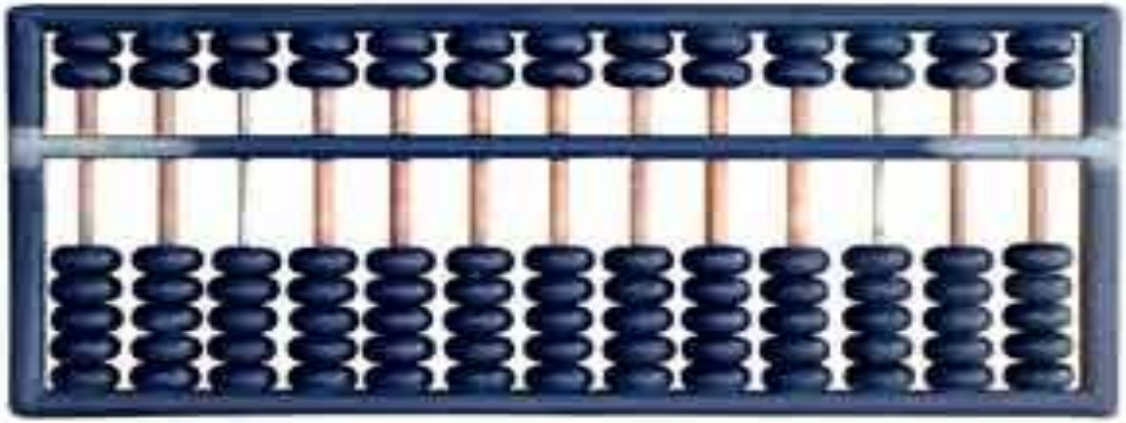
History and Generations of computers

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

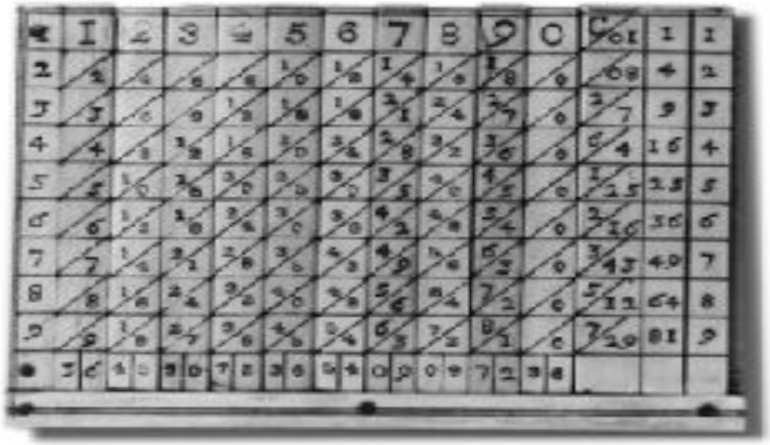
- Abacus (3000 BC)
  It was used to perform addition, subtraction, division and multiplication. It consists of wooden beads and calculation were performed by moving these beads properly.



- 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, Havard Mark 1, ENIAC etc

Generation (Period)	Key hardware technologies	Key software technologies	Key characteristics	Some representative systems
First (1942-1955)	▪ Vacuum tubes ▪ Electromagnetic relay memory ▪ Punched cards secondary storage	▪ Machine and assembly languages ▪ Stored program concept ▪ Mostly scientific applications	▪ Bulky in size ▪ Highly unreliable ▪ Limited commercial use and costly ▪ Difficult commercial production ▪ Difficult to use	▪ ENIAC ▪ EDVAC ▪ EDSAC ▪ UNIVAC I ▪ IBM 701

Second Generation (1955-1964)

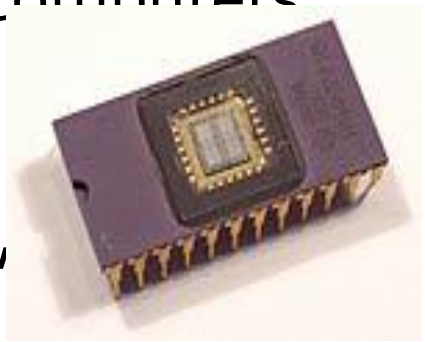
- Bell Lab invented the transistor – function like
  vacuum tubes but smaller, lower power consumption, more reliable.
- Transistor is a small device that transfer electronic signals across a resister
- Lower cost
- Magnetic core memories were used as main memory which is a random-access nonvolatile 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)	▪ Transistors ▪ Magnetic cores memory ▪ Magnetic tapes ▪ Disks for secondary storage	▪ Batch operating system ▪ High-level programming languages ▪ Scientific and commercial applications	▪ Faster, smaller, more reliable and easier to program than previous generation systems ▪ Commercial production was still difficult and costly	▪ Honeywell 400 ▪ IBM 7030 ▪ CDC 1604 ▪ UNIVAC LARC

Third Generation (1963-1971)

- Jack Kilby developed **Integrated Circuit (IC)**
- An IC combined several electronic computers 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)	▪ ICs with SSI and MSI technologies ▪ Larger magnetic cores memory ▪ Larger capacity disks and magnetic tapes secondary storage ▪ Minicomputers; upward compatible family of computers	▪ Timesharing operating system ▪ Standardization of high-level programming languages ▪ Unbundling of software from hardware	▪ 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	▪ 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)	▪ 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	▪ 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	▪ 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	▪ 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)	▪ 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	▪ Micro-kernel based, multithreading, distributed OS ▪ Parallel programming libraries like MPI & PVM ▪ JAVA ▪ World Wide Web ▪ Multimedia, Internet applications ▪ More complex supercomputing applications	▪ 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	▪ 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

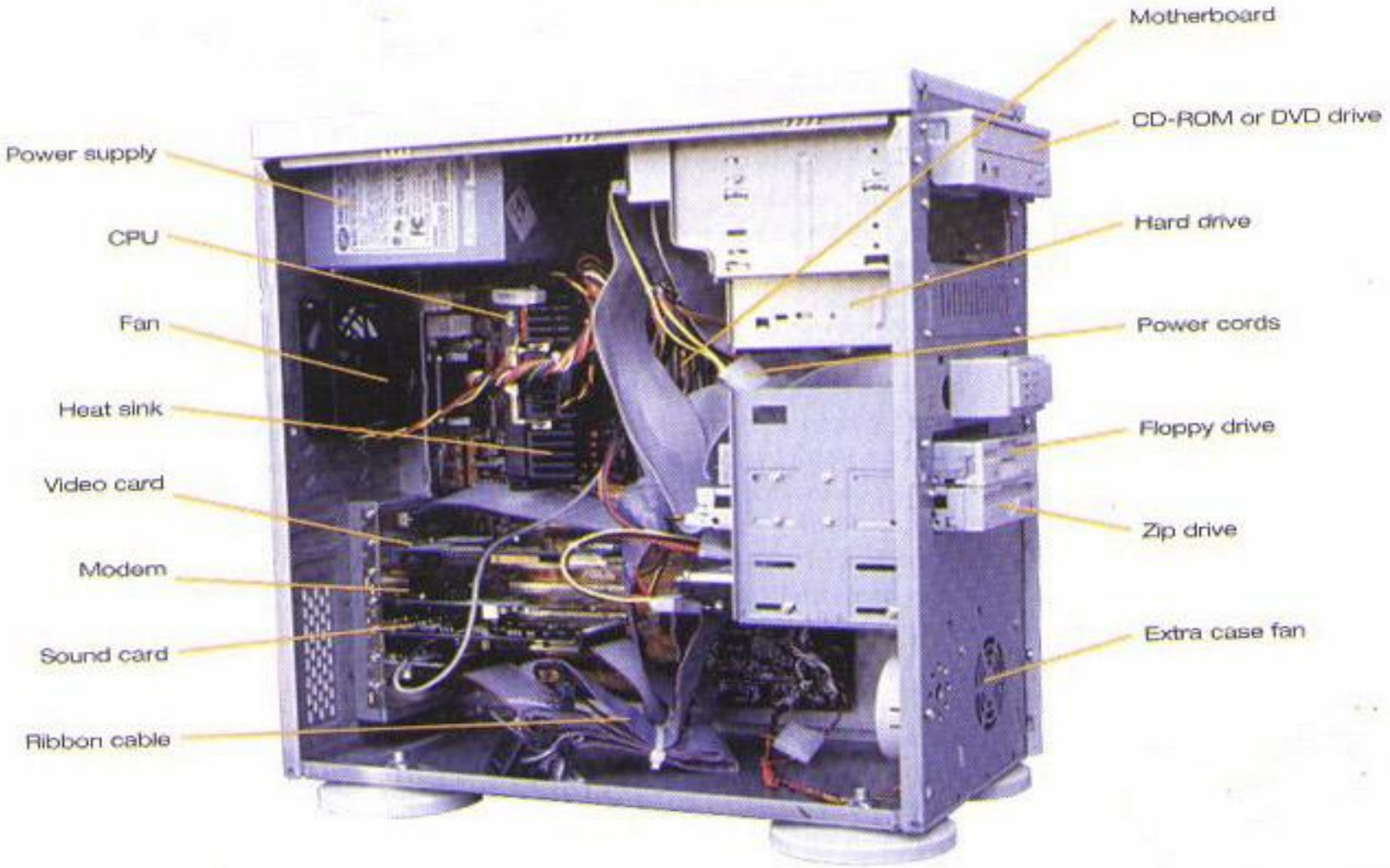
- The devices that are used to enter data and instructions into the computers
- Most commonly used input devices are Keyboard and Mouse

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

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


Motherboard
CD-ROM or DVD drive
Power supply
Hard drive
CPU
Power cords
Fan
Heat sink
Floppy drive
Video card
Zip drive
Modem
Extra case fan
Sound card
Ribbon cable

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 communi
  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

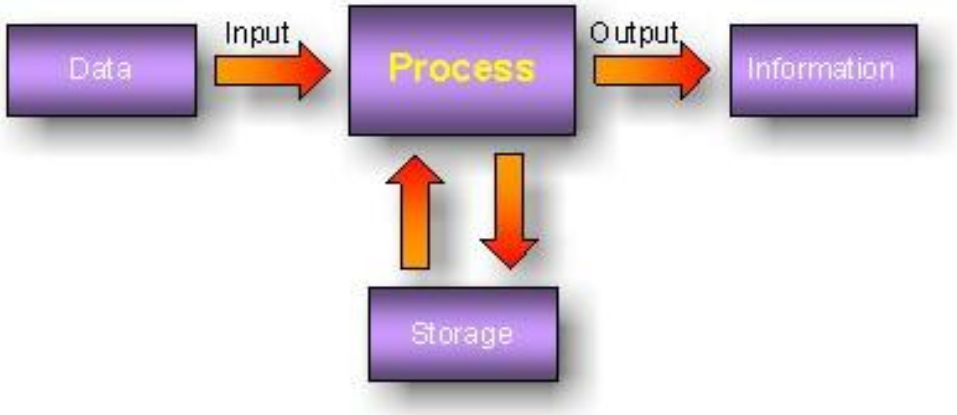
- Data

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

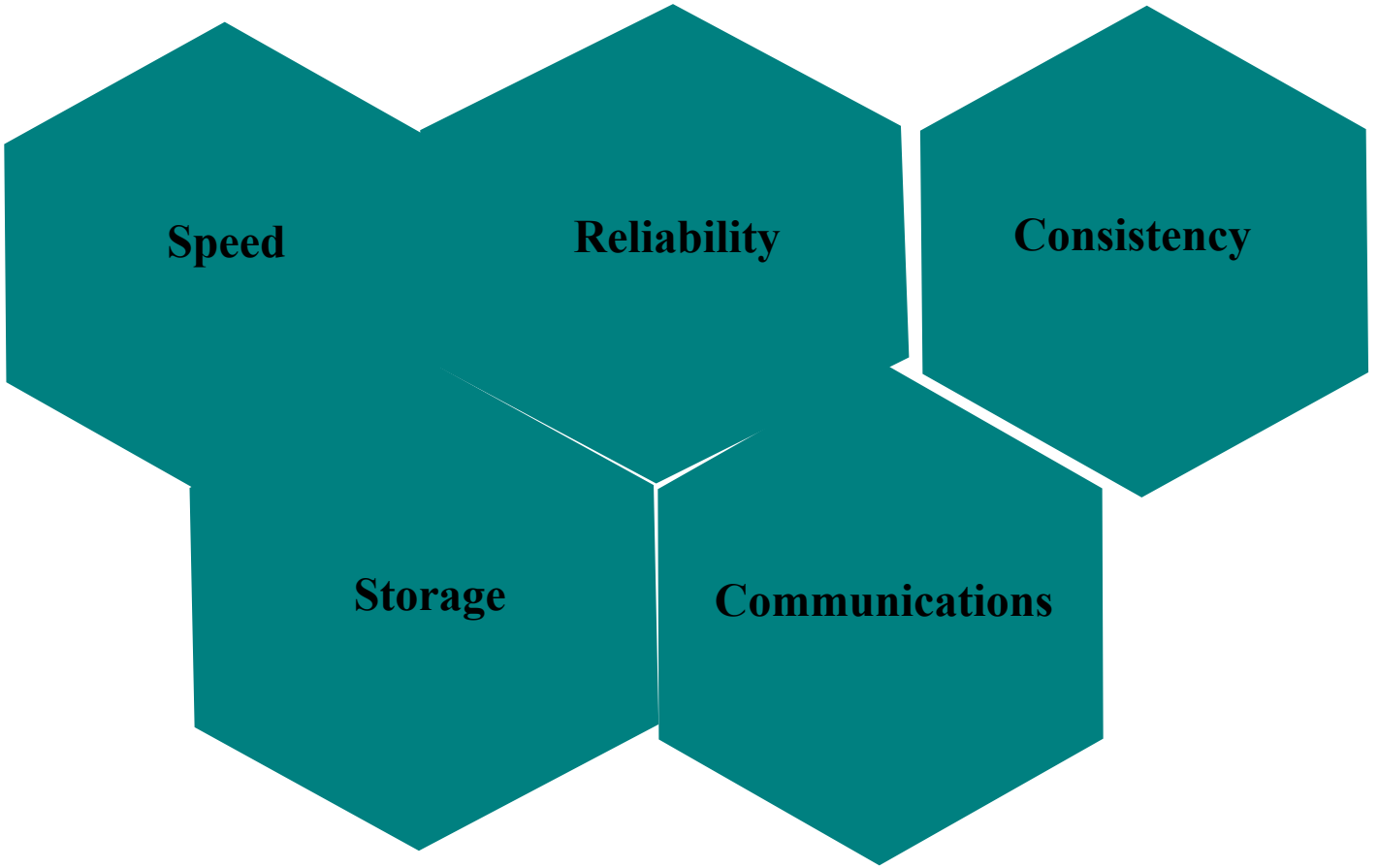
  Processed data is called information. It is more meaningful than data.

Information Processing Cycle

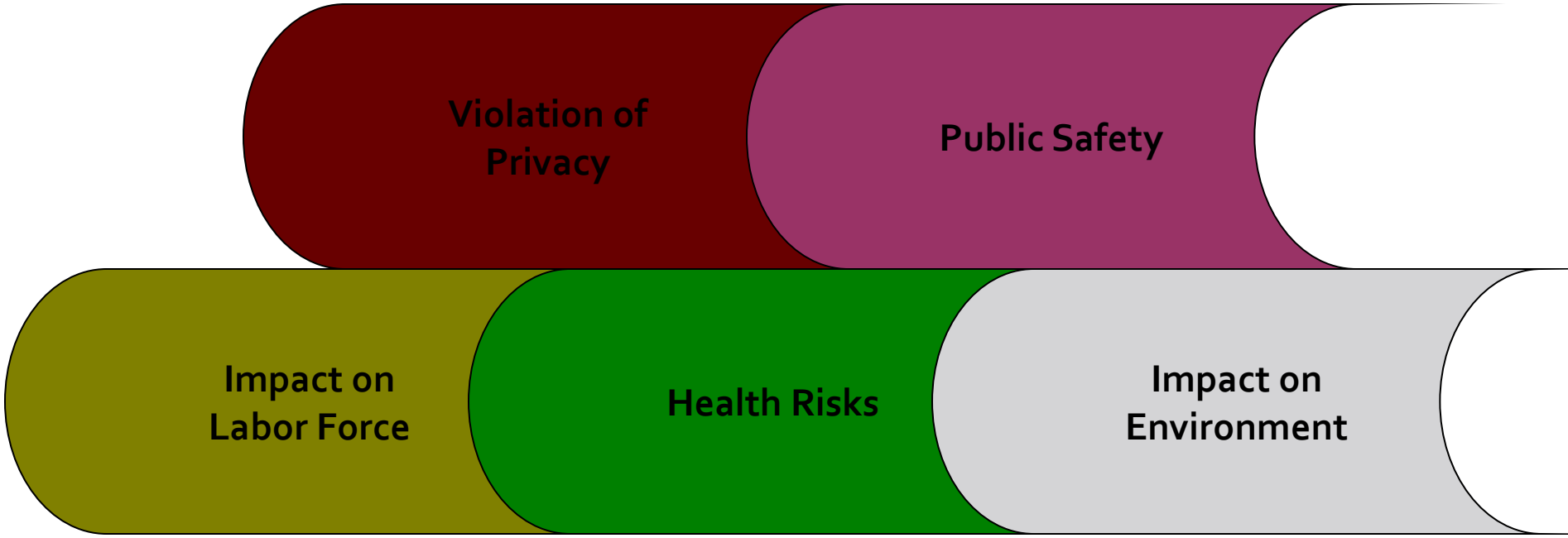
- Data is collected and given to the computer for processing
- Computer process data to the required information
- The information is given to the user as output
- Information is stored in the computer for further use



Advantages of computers



Disadvantages of computers



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תודה
Dankie
Gracias
Спасибо
شكرًا
Merci
Takk
Köszönjük
Terima kasih
Grazie
Dziękujemy
Dėkojame
Ďakujeme
Vielen Dank
Paldies
Kiitos
Täname teid
谢谢
Thank You
Tak
感謝您
Obrigado
Teşekkür Ederiz
감사합니다
Σας Ευχαριστούμ
ขอบคุณ
Bedankt
Děkujeme vám
ありがとうございます
Tack