Computer and its Components

What is a Computer?

- is an electronic device that receives input, stores it for a period of time, operating it according to a set of instructions (also known as programs) and gives a user with an output

Figure 1. Computer

(source: https://clipartpng.com/?745,desktop-computer-png-clipart)

What is a Computer System?

- A computer system is a combination of:
    - **Hardware** – any part of your computer that has a physical structure, such as the keyboard or mouse. It also includes all of the computer's internal parts.
    - **Software** – any set of instructions that tells the hardware what to do and how to do it. Examples of software include web browsers, games, and word processors.
    - **Humanware** – pertains to the user of the computer system.

❖ Hardware Components

- **INPUT DEVICES** – are used to put data and instructions into a computer.

Example of input devices are:

- *Keyboard* – is the most common and very popular input device which helps to input data to the computer. The layout of the keyboard is like that of traditional typewriter, although there are some additional keys provided for performing additional functions. Keyboards are of two sizes 84 keys or 101/102 keys, but now keyboards with 104 keys or 108 keys are also available for Windows and Internet.

  The keys on the keyboard are as follows:

  - Typing Keys – these keys include the letter keys (A–Z) and digit keys (09) which generally give the same layout as that of typewriters.
  - Numeric Keypad – it is used to enter the numeric data or cursor movement. Generally, it consists of a set of 17 keys that are laid out in the same configuration used by most adding machines and calculators.
  - Function Keys – the twelve function keys are present on the keyboard which are arranged in a row at the top of the keyboard. Each function key has a unique meaning and is used for some specific purpose.
  - Control keys – these keys provide cursor and screen control. It includes four directional arrow keys. Control keys also include Home, End, Insert, Delete, Page Up, Page Down, Control(Ctrl), Alternate(Alt), Escape(Esc).
  - Special Purpose Keys – keyboard also contains some special purpose keys such as Enter, Shift,

Caps Lock, Num Lock, Space bar, Tab, and Print Screen.

Figure 2. Keyboard

- *Mouse* – the most popular pointing device. It is a very famous cursor–control device having a small palm size box with a round ball at its base, which senses the movement of the mouse and sends corresponding signals to the CPU when the mouse buttons are pressed. Generally, it has two buttons called the left and the right button and a wheel is present between the buttons. A mouse can be used to control the position of the cursor on the screen, but it cannot be used to enter text into the computer.

Figure 3. Mouse

- **CENTRAL PROCESSING UNIT (CPU)** – manipulates raw data into more useful form and controls the other parts of the computer system. It is a small chip inside the computer. 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. CPU does all the decisions and calculations and consists of several sections such as:

- *Control Unit (CU)*– controls operations of other parts of CPU as well as parts of the computer by sending a control signal
- *Arithmetic and Logic Unit (ALU)*– consists of a complicated set of logic circuit and accumulator. It is mainly responsible for calculation and logical comparison and decision.

Figure 4. Intel's CPU

(source: https://www.pcgamesn.com/intel/comet-lake-release-date-performance-specs-price)

- **MAIN MEMORY**– temporarily stores data and program instructions during processing. Below are two types of main memory:
  - RAM –It is the part of the computer that temporarily stores the instructions that the computer is running, and the data it is processing.
  - ROM– stands for read–only memory. It is used in most computers to hold a small, special piece of software: the "boot–up" program. Non–volatile storage.

Figure 5. RAM

(source: https://computer.howstuffworks.com/computer-memory1.htm)

How to remember the difference between RAM and ROM?		
	RAM	ROM
1. Contents are lost when the computer is turned off.	✓	
2. Contents are not lost when the computer is turned off.		✓
3. Stores instructions that tell the computer how to start up.		✓
4. Stores data and programs currently in use.	✓	
5. Your computer will perform faster with more of this.	✓	
6. This cannot be written to (altered)…only read.		✓

- **OUTPUT DEVICES**– are used to get the result of the processing done by the computer. Computer output devices receive information from the computer, and carry data that has been processed by the computer to the user. Output devices provide data in myriad different forms, some of which

include audio, visual, and hard copy media. The devices are usually used for display, projection, or for physical reproduction. Monitors and printers are two of the most commonly-known output devices used with a computer.

- **Monitor** – This is the most common computer output device. It creates a visual display by the use of which users can view processed data. Monitors come in various sizes and resolutions.

  Common Types of Monitors

  - ✓ *Cathode Ray Tube* – this uses phosphorescent dots to generate the pixels that constitute displayed images.
  - ✓ *Liquid Crystal Display* – LCD monitors replaced the CRT. Initially, they had performance issues to do with response times, but eventually, those problems were solved. Liquid crystal molecules are placed between two electrodes. The amount of light that can pass through the liquid crystal molecules is determined by the amount of electrical charge applied to the electrodes. LCD Monitors require backlighting in order to illuminate the image for us to see. This backlighting technology has also undergone some revolutionary changes.
  - ✓ *Light Emitting Diode* – are essentially LCD screens with LED backlighting to illuminate the LCD image.
  - ✓ *Quantum Dots Display or QLED* – are used to convert the backlight to emit pure basic colors.

These semiconductor nanocrystals are placed in a Quantum Dot layer in order to help RGB color filters by reducing light losses and color crosstalk.

Electro–emissive versions are in its experimentation stages. This means, by applying an electric current to inorganic nano–particles, a pixel is formed by a Quantum–Dot Light Emitting Diode (QD–LED). This would allow for great color ranges and near–perfect black levels on the display.

All monitors depend on a video card, which is positioned either on the computer motherboard or in a special expansion slot. The video card sorts out the computer data into image details that the monitors can then show.

Figure 6. Computer LED Monitor

(source: https://www.amazon.in/Dell–19–5–inch–49–5–Monitor/dp/B012AQIQ48)

- **Printer** – this device generates a hard copy version of processed data, like documents and photographs. The computer transmits the image data to the printer,

which then physically recreates the image, typically on paper.

Types of Printers

- ✓ *Ink Jet* – this kind of printer sprays tiny dots of ink onto a surface to form an image.
- ✓ *Laser* – this type utilizes toner drums that roll through magnetized pigment, and then transfers the pigment onto a surface.
- ✓ *Dot Matrix* – dot matrix printers utilize a print head to set images on a surface, using an ink ribbon.

Figure 7. Laser Printer

(source: https://www.amazon.in/Canon-TS3370s-Wireless-Inkjet-Printer/dp/B08238B2KH)

- **SECONDARY MEMORY** – is used to store programs and data when they are not being used. Alternatively referred to as *external memory, secondary memory,* and *auxiliary storage*, a secondary storage device is a non-volatile device that holds data until it is deleted or overwritten. Secondary storage is about two orders of magnitude cheaper than primary storage.

  Examples of Secondary Memory:

  - **Hard drive** – a hard disk drive (sometimes abbreviated as a hard drive, HD, or HDD) is a non-volatile data storage device. It is usually installed internally in a computer, attached directly to the disk controller of the

computer's motherboard. It contains one or more platters, housed inside of an air–sealed casing. Data is written to the platters using a magnetic head, which moves rapidly over them as they spin.

Internal hard disks reside in a drive bay, connected to the motherboard using an ATA, SCSI, or SATA cable. They are powered by a connection to the computer's PSU (power supply unit).

Examples of data stored on a computer's hard drive include the operating system, installed software, and the user's personal files.

Figure 8. Hard disk drive

(source: https://www.computerhope.com/jargon/h/harddriv.htm)

- **Flash Drive** – alternatively referred to as a USB flash drive, data stick, pen drive, memory unit, keychain drive, and thumb drive, a jump drive is a portable storage device.

  It is often the size of a human thumb (hence the name), and connects to a computer via a USB port. Flash drives are an easy way to store and transfer

information between computers and range in sizes from 2 GB to 1 TB.

Figure 9. Flash drive

(source: https://www.computerhope.com/jargon/j/jumpdriv.htm)

❖ Software Components

- Sometimes abbreviated as **SW** and **S/W**, software is a collection of instructions that enable the user to interact with a computer, its hardware, or perform tasks.
- Without software, most computers would be useless. For example, without your Internet browser software, you could not surf the Internet or read this page. Without an operating system, the browser could not run on your computer. The picture shows a Microsoft Excel box, an example of a spreadsheet software program.

Types of Software

- **SYSTEM SOFTWARE** – System software, also Operating System (OS) is software that manages other software and devices in a computer. The operating system manages the computer hardware resources in addition to applications and data. Without systems software installed in our computers we would have to type the

instructions for everything we wanted the computer to do!

- **APPLICATION SOFTWARE** – or simply applications, are often called productivity programs or end–user programs because they enable the user to complete tasks, such as creating documents, spreadsheets, databases and publications, doing online research, sending email, designing graphics, running businesses, and even playing games! Application software is specific to the task it is designed for and can be as simple as a calculator application or as complex as a word processing application. When you begin creating a document, the word processing software has already set the margins, font style and size, and the line spacing for you. But you can change these settings, and you have many more formatting options available. For example, the word processor application makes it easy to add color, headings, and pictures or delete, copy, move, and change the document's appearance to suit your needs.

Figure 10. Different application software

(source: https://sciencerack.com/types-of-application-software/

The figure above shows the different applications software such as Adobe Photoshop for creating and editing images, Microsoft Word

for typing and documentation task, VLC multimedia player for playing video files such as music videos and movies, Adobe Acrobat Reader for viewing, printing, signing, sharing, and annotating PDFs, Google Chrome and Internet Explorer for online browsing.

Applications or just apps, are end–user software which contain basic to advanced sets of digital tools, designed for productivity tasks such as arithmetic summation and text editing. They are at the end of the software queue because they enable users to accomplish complex to simple productivity tasks.

Most application software are designed to run on three popular platforms: *desktops, mobiles,* and *browsers.*

The two types of application software:

- **General Purpose Applications** – these are off–the–shelf software types which accomplish broad range of tasks as opposed to custom software which accomplish tasks specific to user requirements. General purpose applications are available in standalone modes or are bundled together to make up application suites.
    - **Word Processors** – these are types of application software with basic tools to create, edit, format and save text files until they are WSYWIG (what you see is what you get). The saved files can then be sent to the printer to produce hard copy output or used for other purposes.

      Word processors can be used to create multiple kinds of documents including reports, letters, newsletters, invoices, manuals, and has additional features such as mail merge, email and send to blog.

Besides, they can be tuned to for advanced formatting of graphics for publishing.

Examples of word processing applications: *MS Word, WPS Writer and Apple Pages.*

- **Electronic Spreadsheets** – spreadsheets are used to manipulate large amounts of financial data in business, science or for personal accounting. Numeric or text data are entered in cells of tables to be calculated, compared and analyzed using select formulas.

  The information gathered from these calculations are laid out for report preparation and presentation.

  Additional features in spreadsheets include the creation of graphs, charts, 3D data maps, pivot tables, forecasting etc.
  MS Excel, LibreOffice Calc, and Google Sheets are examples of spreadsheets.

- **Data Management –** database applications are containers of related data for processing, analysis, storage and retrieval. They are comparable to a book library where items are stored in orderly forms, for ease of manipulation and access.

  Typical desktop applications like *MS Access, Filemaker* and *dBASE* are used for operational assignments to create, organize and update all

kinds of related records like inventories, mailing lists, purchases, catalogs, phone numbers etc.

They allow users to query for specific information and generate reports with relative ease.

- **Accounting – t**he field of accounting is about communicating financial details in a business by recording, manipulating, sorting, storing, summarizing and retrieving financial transactions in a comprehensive manner. Ultimately, general–purpose accounting packages will be used to create and present balance sheets, income and financial statements, tax reports, all according to set rules and procedures.

  A good accounting setup must also be vetted regularly by external auditing firms to ensure it complies with set standards which govern financial establishments. Besides the eagle eye of auditors, the services of professional accounting firm can be sought to help streamline procedural requirements.

  Popular accounting software series for small businesses include *Quickbooks, Zoho Books* and *Sage*.

- **Presentation** – presentation software are used to display ideas or concepts for business and educational purposes, in a slideshow format. Popular tools like bulleted lists, graphs, charts,

animations, texts, audio and video are used in creating slide–shows.

These applications rely on the computer VGA or other output ports, projector or smartboard to display slide contents.

Additional features include screen recording, sharing and collaboration,

Keynote, MS PowerPoint and *Google Slides* are examples of presentation applications.

- **Desktop Publishing (DTP) –** used to create illustrations, animations and 3D images using text and graphics embedded within the clipart library. DTP page layout features design tools and other elements with which the user can create quality typographic texts and imaginative graphics.

  The end result of work done in DTPs are brochures, newsletters, fliers, logos, magazines, newspapers, business and other cards, 3D models etc, for publishing or printing.

  Adobe Illustrator, In–design and *Microsoft Publisher* are but a few of popular DTPs.

- **Computer Aided Design (CAD) and Computer Aided Manufacturing –** CAD and CAM applications are used by artists and engineers to create 2D and 3D drawings, technical drawings of electrical and

automotive structures, media and film animation, interior design and 3models, and surveying. They are meant for professionals that have assignments to produce product models on the computer before implementing the final design in the real world.

CAD applications are commonly used to make architectural and construction drawings and used to design cars, ships, planes, weapons and other forms of machinery.

Popular software in this category include *AutoCAD, ArchiCAD* and *PowerShape.*

- **Digital Video Editing –** are tools used to edit motion video footage and sound recordings by sequencing and trimming clips and adding special effects. The goal is to manipulate recorded events to enhance the quality of presentation.

  Edits can be made on recordings made in movie industries, television shows, documentaries, advertisements and in private events.

  Adobe Premiere, Pinnacle Studio, and *Final Cut* studio are examples of editing applications.

- **Educational Reference –** helps students learn new information and skills through interactive presentations. A computer–aided instruction (CAI) application helps students learn how to fix things, new languages, strengthen math skills etc.

Educational simulations of computerized models allow students to simulate experiments which would otherwise be tricky to do in the classroom. Students can also build own computerized models, which they can share with other students locally and globally.

Electronic maps, Encarta encyclopedias, Britannica, electronic dictionaries and *electronic books* are educational applications.

- **Computer Games –** are probably the most popular form of entertainment with the young users. They are more or less similar to games played on video consoles. Typically, they involve users interacting with avatars and other kinds of characters on the display panels to drive, play card games, solve mysteries, fly simulation planes, engage in virtual warfare etc.

  Gamers use all sorts of control tools to interact with selected games. popular are keyboards, joysticks, voice and gestures.

  Besides games played between two individuals at home, online games are played between different people from anywhere in the world using the internet.

  Popular desktop games are *Batman, Need for Speed, Dead Rising, Angry Birds, FIFA Football, Pokemon Go etc.*

- **Web Browsers** – browsers are used to accomplish lots of activities on the internet known as world wide web (WWW). They are also used to source for information on local networks or file servers. Browsers allow users to search, upload, read and even download text files, music, videos, images, web pages and other content from millions of resources available online.

  Google, Edge, Safari, Opera and *Firefox are* the most popular browsers in the market.

- **Search Engines** – are types of application software which are used to search for information on the internet. They work on top of browsers and use crawling or spider–like scripts to search for user requests from every corner of the world wide web.

  When a user types a search query in the browser, search engine algorithms immediately go to work inside web page and directory databases to look for information that best answers user requests.

  Popular search engines include *Google Search, Baidu, Bing, Wolfram Alpha, Yandex* and *DuckDuckGo*.

- **Communication Software** – these are applications which facilitate remote transmission of information between two or more computer users. Transmission typically happens using internet or intranet and other types of network infrastructure.

These applications facilitate all kinds of transfer ranging from audio, video, text and graphics files to real–time chats.

Communication tools can be grouped under the following:

- ✓ Email e.g. Hotmail, Yahoomail and Gmail.
- ✓ Social network e.g. Facebook, WeChat and Twitter.
- ✓ Videoconferencing e.g. ChatBlazer, Google Hangout and GoToWebinar.
- ✓ Instant messaging e.g. Whatsapp, Facebook messenger and QQ International.
- ✓ VOIP e.g. Skype, Viber and Whatsapp.
- ✓ Private Branch Exchange (PBX) e.g. Asterik, FreePBX and FreeSWITCH

- **Web Development** – web design applications are used to create interactive pages which add up to websites. The pages are usually collections of electronic documents, images, audio/visual files and applications that reside on a web server and are accessible through computers connected to the Internet. A website owner then uses them to advertise, sell or provide educational information about specific products.

  Adobe Dreamweaver, Microsoft FrontPage, are examples of web development software.

- **Other Categories of Application Software**

- ✓ Network software: CytoScape, Snort and igraph.
- ✓ Data analysis: SPSS, SAS and Stata.
- ✓ Medical software: Advanced MD, FreeMED and Compulink.
- ✓ Religious software: e–Sword, OpenLP and Logos Bible Software.
- ✓ Virtual applications: Virtual Box, VMware and Windows Virtual PC.
- ✓ Multimedia: Movie Edit Pro, Sony ACID Music Studio and Maya.
- ✓ Media players: Power DVD, VLC and Windows Media Player.
- ✓ Animation software: Cinema 4D, Maya and Blender.
- ✓ Simulation software: Simulink, Enterprise Dynamics and MATLAB.
- ✓ Document viewers: Adobe Reader, DocX Viewer and FreeFileViewer.
- ✓ File Transfer Protocol(FTP): File Zilla, Cyberduck, WinCSP and P2P
- ✓ Remote desktop access: TeamViewer, AeroAdmin and Windows Remote desktop.
- ✓ Cloud storage: Google drive, BackBlaze and SugarSync.
- ✓ Music production: Fruity Loops, Logic Pro and Garageband.
- ✓ Photo editing: Photoshop, Gimp and Affinity Photo.
- ✓ Braille Editors: DBT Duxbury US, PictureBraille and Lambda.
- ✓ Virtual assistants: Siri, Google Now and Braina.

- **Custom/Bespoke Software** – are tailor–made to provide specific features and tools. They perform only requested functions and may as well contain borrowed features from off–the–shelf applications. Overall, however, they are meant to maximize productivity and provide cordial interfaces for users: this while cutting out the excesses that are integral to general purpose software.

  Custom applications are tweaked to suit the changing demands of the client organization. Tweaks may include adaptations to evolving business trends and removal of obsolete features.

  Custom software can be customized to create;

  - Security and client identification systems.
  - Consumer application portals.
  - Attendance rosters.
  - Custom receipts and invoices.
  - Stock management applications.
  - Student enrollment, performance and records tools.

  Organizations and schools tend to favor custom applications because they work with multiple users and attend to multiple clients.

  The ownership rights of a bespoke application also remain with the client, giving him/her absolute authority to use or sell the application.

A bespoke application can be customized to run on traditional computing setups or inside browsers. Popular examples of bespoke software fall under these categories:

- ✓ School Management Information System (SMIS).
- ✓ Point of Sale (POS).
- ✓ Electronic registration software for schools.