VIRAM SERIES

COMPUTER FUNDAMENTALS

AS PER SBTE, JHARKHAND SYLLABUS OF FIRST SEMESTER POLYTECHNIC STUDENTS

• Concepts • Systems • Applications

KHANNA PUBLISHERS

COMPUTER FUNDAMENTALS

As Per SBTE, Jharkhand Syllabus

of

First Semester Polytechnic Students

Compiled by

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Hologram & Description

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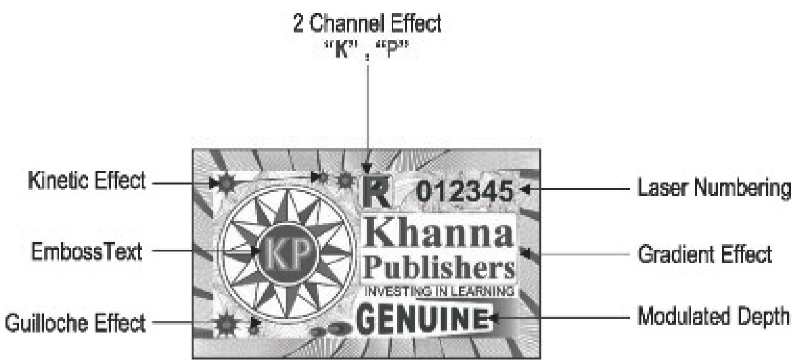

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First Edition : 2017

Preface

The world today is witnessing a new kind of revolution—the *Information Revolution*—ushered by technology. This book dwells on fundamentals that one must learn in order to pursue virtually any endeavour in IT fields. This new edition will be very helpful to the diploma students of SBTE, Jharkhand. This book has been designed on the latest pattern of SBTE, Jharkhand as per E-scheme. Utmost care has been taken to cover the whole syllabus concerning different aspects of fundamentals of computer prescribed in the new syllabus. This book is written to meet the requirement of the modern curricula. The main objective is to teach IT concepts to the students who want the basics of information technology.

Salient Features

- Student friendly—written in clear, concise, and lucid manner.
- Topics explained with illustration.
- Chapter objectives clearly specify learning outcomes
- Lab activities added at the end of each chapter

Although every attempt has been taken to make this edition error-free, some mistakes might be crept in. If you bring to our notice such mistakes, we would be thankful to you, and we shall try to rectify them in the next edition. Any suggestion and comments regarding the improvement of the book will be gratefully acknowledged.

—Publishers

SYLLABUS

Academic Year 2017-18

Course Name : All Branches of diploma in Engineering

Semester : First

Subject Title : Computer Fundamentals

Subject Code : 106/111

Teaching and Examination Scheme :

Teaching Scheme		Examination Scheme						
L	T	P	Full Marks	External Exam marks	Internal Exam Marks	External Pass Marks	Total Pass Marks	Duration of External Exams
02	–	–	50	40	10	13	20	3 Hrs
Sessional		2	50	30	20	–	25	–

NOTE:

Internal marks will be allotted on the basis of two snap tests and 2 assignment of equal marks to be conducted by the faculty teaching the subject

RATIONALE:

In Engineering Education role of computers and its knowledge is day by day increasing and every documentation and analysis requires basic fundamentals of computers. The accessibility to internet and presentation techniques are essential these days which is fully dependent on know-how of computers irrespective of branches or discipline.

OBJECTIVES:

Student will be able to:

1. Understand a computer system that has hardware and software components, which controls and makes them useful
2. Understand the operating system as the interface to the computer system.
3. Use the basic function of an operating system.
4. Set the parameter required for effective use of hardware combined with and application software
5. Compare major OS like Linux and MS-Windows,
6. Use file managers, word processors, spreadsheets, presentation software's and Internet.
7. Have hands on experience on operating system and different application software.
8. Use the Internet to send mail and surf the World Wide Web.

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2.	**Introduction to MS Office** 2.1 **MS-Word :** Introduction, Starting MS-Word Screen and its Components, Elementary Working with MS-Word 2.2 MS-Excel: Introduction, Starting MS-Excel, Basics of Spreadsheet, Elementary Working with MS-Excel 2.3 MS-PowerPoint: Introduction, Starting MS-PowerPoint, Basic of PowerPoint, MS-PowerPoint Screen and Its components, Elementary Working with MS-Word	8	12
3.	**Introduction of Internet** 3.1 What is Internet? 3.2 Computer Communication and Internet. 3.3 WWW and Web Browsers. 3.4 Creating own Email Account. 3.5 Networking and Types	4	6
4.	**Introduction of HTML and Software** 4.1 Introduction to HTML. Working HTML. 4.2 Creating and Loading HTML Pages, Tags. 4.3 Structure of o HTML, document, Stand Alone Tags. 4.4 Formatting Text, Adding Images, Creating Hyper Links, Tables. 4.5 Cyber Security. 4.6 Computer Virus.	8	10
5.	**Information Technology** 5.1 Current IT Tools. 5.2 Social Networking, Mobile computing, Cloud computing. 5.3 Introduction of IOT of IOE. 5.4 Computer Application in various fields like Data analysis, Database Management, Artificial Intelligence. 5.5 Networking and Types	6	6
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CHAPTER 1 Fundamentals of Computer

Objectives

After studying this lesson, students should be able to know about:

- Definition of computers and its basic features.
- Definition of various components of the computer system.
- The historical aspects of the computers.
- The concept of bus structure.
- Processor performance and measurement.

1.1 INTRODUCTION

When we speak about computers, what exactly are we referring to? Many of us tend to define a computer as a computing machine, as in calculator.

However, this definition strips the computer of 95% of its total capabilities. In layman terms, a computer can be defined as a machine that is used to generate some kind of information from the data that is fed into the computer.

The application areas of computers are unlimited. We find a computer in every aspect of our life. From a simple operation as playing a video game to more complicated applications as weather forecasting computers are found everywhere.

Figure 1.1. Computer.

Let us take a simple example of a person who needs to purchase a can of juice from a super market. He walks inside the supermarket, picks up a can of juice and proceeds to the cash counter. The counter person scans the code that is present in the label to generate a bill. This scanning of the code is computerized. The man pays his bills with his credit card and walks off the super market. He just used a computer, which will transfer the cost of the can of juice from his bank account to the super market. The man then moves across the street and enters the office of his travel agent. He tells the agent that he plans to take a vacation and inquires about the places that he can possibly go. The agent turns to his computer, presses a couple of keys and gets the list of the prospective places immediately. The agent just used a *database* application of the computer. The man selects a place and confirms his travel. The agent again turns to his computer and moments later hands him the air tickets to that place. The agent actually connected to a computer that did the reservation. The man then happily comes to his office and decides to inform his wife about the vacation. He, therefore, sends an e-mail to his wife. The man used a network application of the computer. Numerous examples of such kind can be sited. With the advent of technology, newer and newer application domains of the computer are created everyday. It is just a matter of time when life without computers cannot be imagined.

1.2 COMPONENTS OF COMPUTER SYSTEM

A computer system is made up of both hardware and software. Software is another term for a computer program. Software controls the computer and makes it do useful work. Without software a computer is useless, akin to a car without someone to drive it. Hardware refers to the physical components that make up a computer system. These include the computer's processor, memory, monitor, keyboard, mouse, disk drive, printer and so on. In these notes, we take a brief look at the functions of the different hardware components. In addition, we describe the some of the essential software required for the operation of a computer system.

A computer system is made up of a number of electronic devices connected together. Figures 1.2 and 1.3 show the block diagrams of a typical computer system.

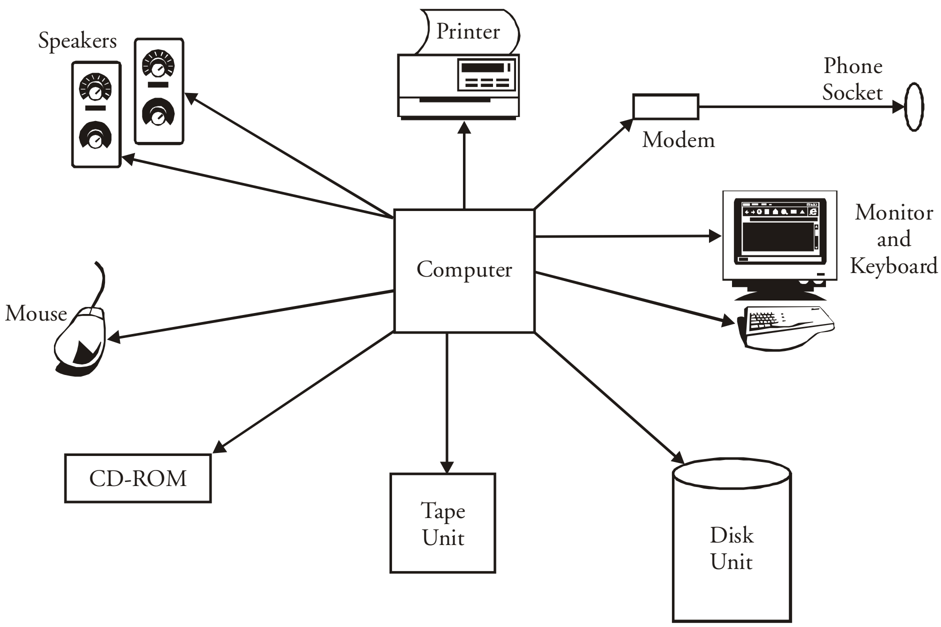


Figure 1.2: Components of Computer

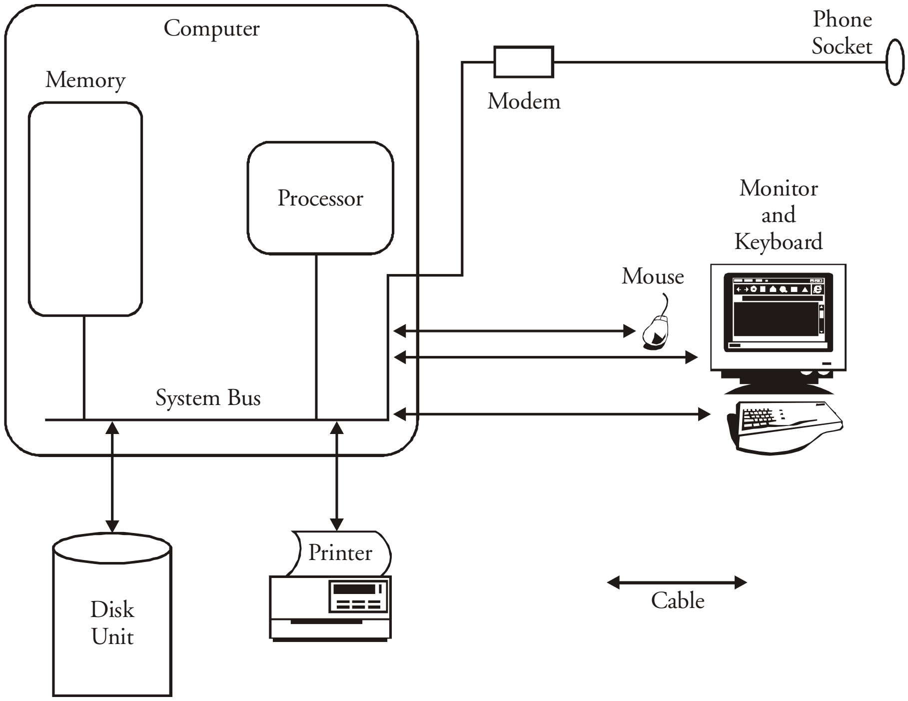


Figure 1.3 : Typical computer system: Processor and Memory (RAM)

A computer has two major internal components that are of particular interest to us, namely its processor and its memory. There will also be a power supply unit (not shown) to provide power for the system. The term device is used to describe any piece of hardware that we connect to a computer such as a keyboard, monitor, disk drive, printer and so on. Such devices are also sometimes described as peripheral devices or simply peripherals. They may be classified as Input/ Output (I/O) devices and storage devices. As the name suggests, I/O devices are responsible for communicating with the computer, providing input for the computer to process and arranging to display output for computer users. The keyboard and mouse are commonly used input devices. The monitor is the commonest output device, followed by the printer for hardcopy (permanent) output. Storage devices are used to store information in a computer system. The memory is used to store information inside the computer while the computer is switched on. Disk storage is the commonest form of external storage, followed by the tape storage. External storage devices can store information indefinitely or more realistically, for some number of years. A very important component of a computer system is the system bus. This is used to transfer information between all system components.

1.3 TYPES OF COMPUTER

Computers can be categorized based on their size and design. Modern computers can vary in size ranging from the one that fills the entire room to a size that is small enough to fit the nail of your thumb with room to spare. It is a general tendency that the larger the system, the greater is the processing speed, storage, cost and the ability to handle a number of peripheral devices. The difference in size also varies the number of users that can work on the system simultaneously. At the lowest end of the size scale is the microcomputer. They are small devices that can be used to perform dedicated tasks like scanning the code of a can of juice. The more familiar personal computer is a kind of a microcomputer. A typical microcomputer is shown in Figure 1.4.

Figure 1.4 : A Typical Laptop Microcomputer

Next in the line is the **minicomputer** as shown in Figure 1.5. These are also small general-purpose computers having the capability to serve a number of users simultaneously. They are generally more powerful and expensive than the microcomputers. In size, they range from desktops to a size of a small file cabinet.

The **mainframe** computers are much bigger in size and offer very high processing speed and storage capacity. Finally, the supercomputers are the fastest and the most expensive systems in the world. They are typically used for complex scientific operations like weather forecasting, statistical analysis, etc.

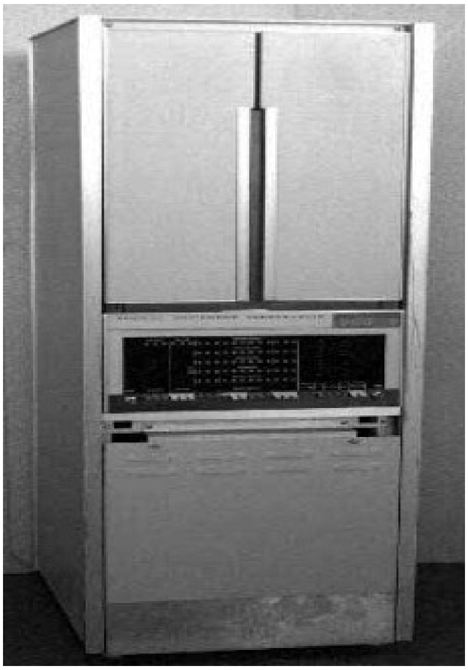


Figure 1.5 : A Minicomputer

Mainframe computers (colloquially referred to as "big iron" are computers used primarily by large organizations for critical applications, bulk data processing, such as census, industry and consumer statistics, enterprise resource planning, and transaction processing.

The term originally referred to the large cabinets called "main frames" that housed the central processing unit and main memory of early computers.

Later, the term was used to distinguish high-end commercial machines from less powerful units. Most large-scale computer system architectures were established in the 1960s, but continue to evolve.

Modern mainframes can run multiple different instances of operating systems at the same time. This technique of virtual machines allows applications to run as if they were on physically distinct computers. In this role, a single mainframe can replace higher-functioning hardware services available to conventional servers. While mainframes pioneered this capability, virtualization is now available on most families of computer systems, though not always to the same degree or level of sophistication

Figures 1.6 and 1.7 show a mainframe and a supercomputer respectively.

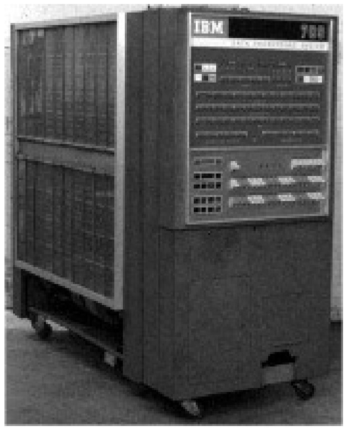


Figure 1.6 : Mainframe Computer

Figure 1.7 : Some Supercomputers

Computers can be classified on the basis of their design. Most of today's computers follow the design that was formulated by John Von Neumann and others in the mid 1940s. This design was called the **Von Neumann Architecture**. This design had a single control, primary storage and arithmetic and logic unit in the processor unit. It interpreted and processed the data as a single sequential stream. A single channel was available that was used to transfer data from the storage. This limited the speed at which the computer could operate. This design, therefore, was replaced by newer designs in which there are additional storage, control and arithmetic-logic sections. This enabled the simultaneous processing of a number of instructions. In essence, they were **multiprocessor** systems. The Von Neumann design is based on three essential concepts which are as follows:

- A single read-write memory stores the data and the instructions.
- The type of the data contained in the memory can be addressed by location.
- Execution occurs from one instruction to another i.e. sequentially.

1.3.1 Generation of Computers

Computer production started in the 1940s when the first electronic computer was created. Since then, the improvements and enhancements in the field of electronics had considerable influence on the design of computers thus leading to what is known today as **Generation of Computers**.

First Generation

Dr. John Vincent Atanasoff and Clifford Berry created the first electronic computer. They called it the *Atanasoff-Berry Computer* (*ABC*). The ABC used vacuum tubes for storage and arithmetic and logical functions. This work was observed by John W. Mauchly, who in 1940-41 teamed up with J. Presper Eckert Jr., and organized the construction of the ENIAC. The ENIAC, shown in Figure 1.8, was the first general purpose computer to be put fully in operation.

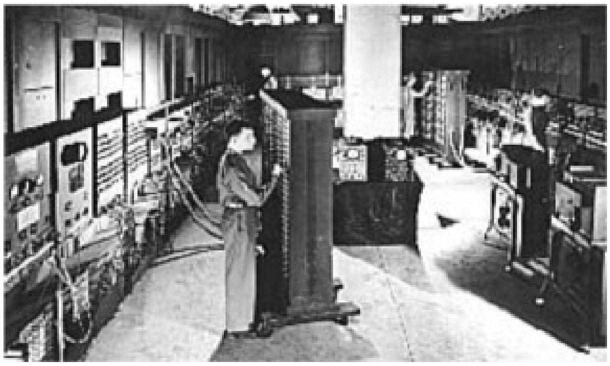


Figure 1.8 : ENIAC

Using vacuum tubes (Fig. 1.9), the ENIAC could perform 300 multiplications per second. However, the fact that it weighed 30 tons and occupied the space of a three bedroom house was the major disadvantage of this computer. In the mid 1940s, John Von Neumann published a paper where he gave the concept of stored program and using binary number system for computation purposes. This idea was incorporated into a new computer called the EDVAC and then the EDSAC. Later in time, the UNIVAC, shown in Figure 1.10, came into existence.

Figure 1.9 : Vacuum Tubes

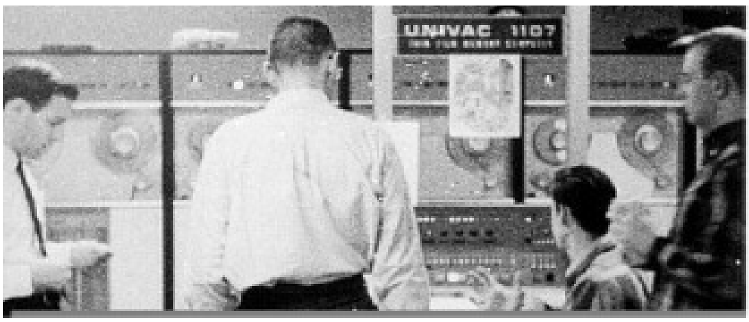


Figure 1.10 : UNIVAC

Second Generation

The main disadvantage of the first generation computers was the fact that the vacuum tubes, owing to their short life, had to be replaced frequently and they generated a lot of heat. These computers took up a lot of space and programming them was a tedious task because programs had to be written in machine language. In the 1950s, these disadvantages led to the creation of computers, which were much smaller and faster.

Figure 1.11 : IBM 7000 Series Computer

In addition to this, programming in these computers was easy because they understood *high-level programming languages*. These languages were more English like and easy to understand. The computers in this generation used solid state components such as the transistors developed by the Bell Laboratories. Some computers of this generation are LEO mark III, ATLAS and the IBM 7000 series, shown in Figure 1.11.

Third Generation

The second-generation computers were well suited to do either scientific or non-scientific applications but not both. Thus, in 1964, IBM announced the *System 360 family* of mainframes, where each processor had a set of large built-in instructions. Some of these instructions could be used effectively for scientific calculation while the others were more suited for record-keeping applications. The computers in this generation used the technology of **Integrated Circuits** (IC). Since the ICs were small in size, there was a further reduction in size of these computers. A typical IC is shown in Figure 1.11.

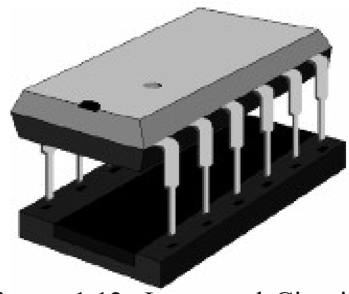


Figure 1.12 : Integrated Circuit (IC)

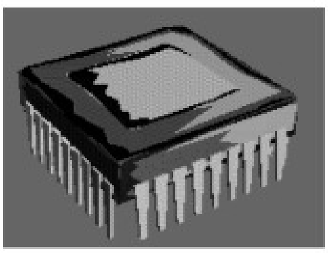


Figure 1.13 : VLSI Chip

Fourth Generation

As the technology advanced, the size of the ICs reduced and more and more components could be packed into smaller chips. They were called **Large Scale Integration** (LSI) and **Very Large Scale Integration** (VLSI) chips, as in Figure 1.13. Since the computers in this generation used these chips, their size was greatly reduced. The speed at which they operated increased and their cost decreased. The computers of today are said to be of the fourth generation.

Fifth Generation

It had been predicted that by early 21st century, computers should be able to behave like human making interaction more human like. They would be able to think and act on their own. This situation is very well depicted in the motion picture *Terminator II* where the computers acts on their own, based on their own judgment.

1.3.2 Personal Computer Types

Actual personal computers can be generally classified by size and chassis/case. The chassis or case is the metal frame that serves as the structural support for electronic components. Every computer system requires at least one chassis to house the circuit boards and wiring. The chassis also contains slots for expansion boards. If you want to insert more boards than there are slots, you will need an expansion chassis, which provides additional slots. There are two basic flavours of chassis designs—desktop models and tower models—but there are many variations on these two basic types. Then come the portable computers that are computers small enough to carry. Portable computers include notebook and sub-notebook computers, hand-held computers, palmtops, and Personal Digital Assistants (PDAs).

Tower model

The term ‘Tower model’ refers to a computer in which the power supply, motherboard, and mass storage devices are stacked on the top of each other in a cabinet. This is in contrast to desktop models, in which these components are housed in a more compact box. The main advantage of tower models is that there are fewer space constraints, which makes installation of additional storage devices easier.

Desktop model

A computer designed to fit comfortably on the top of a desk, typically with the monitor sitting on top of the computer. Desktop model computers are broad and low, whereas tower model computers are narrow and tall. Because of their shape, desktop model computers are generally limited to three internal mass storage devices. Desktop models designed to be very small are sometimes referred to as slim line models.

Notebook computer

It is an extremely lightweight personal computer. Notebook computers typically weigh less than 6 pounds and are small enough to fit easily in a briefcase. Aside from size, the principal difference between a notebook computer and a personal computer is the display screen. Notebook computers use a variety of techniques, known as flat-panel technologies, to produce a lightweight and non-bulky display screen. The quality of notebook display screens varies considerably. In terms of computing power, modern notebook computers are nearly equivalent to personal computers. They have the same CPUs, memory capacity, and disk drives. However, all this power in a small package is expensive. Notebook computers cost about twice as much as equivalent regular-sized computers. Notebook computers come with battery packs that enable you to run them without plugging them in. However, the batteries need to be recharged every few hours.

Laptop computer

A small, portable computer — small enough that it can sit on your lap. Nowadays, laptop computers are more frequently called notebook computers.

Sub-notebook computer

A portable computer that is slightly lighter and smaller than a full-sized notebook computer. Typically, sub-notebook computers have a smaller keyboard and screen, but are otherwise equivalent to notebook computers.

Hand-held computer

A portable computer that is small enough to be held in one’s hand. Although extremely convenient to carry, handheld computers have not replaced notebook computers because of their small keyboards and screens. The most popular hand-held computers are those that are specifically designed to provide PIM (personal information manager) functions, such as a calendar and address book. Some manufacturers

Figure 1.14 : Handheld computer

are trying to solve the small keyboard problem by replacing the keyboard with an electronic pen. However, these pen-based devices rely on handwriting recognition technologies, which are still in their infancy. Hand-held computers are also called PDAs, palmtops and pocket computers.

Palmtop

A small computer that literally fits in your palm. Compared to full-size computers, palmtops are severely limited, but they are practical for certain functions such as phone books and calendars. Palmtops that use a pen rather than a keyboard for input are often called hand-held computers or PDAs. Because of their small size, most palmtop computers do not include disk drives. However, many contain PCMCIA slots in which you can insert disk drives, modems, memory and other devices. Palmtops are also called PDAs, hand-held computers and pocket computers.

PDA

It stands for personal digital assistant, a hand-held device that combines computing, telephone/fax, and networking features. A typical PDA can function as a cellular phone, fax sender, and personal organizer. Unlike portable computers, most PDAs are pen-based, using a stylus rather than a keyboard for input. This means that they also incorporate handwriting recognition features. Some PDAs can also react to voice input by using voice recognition technologies. The field of PDA was pioneered by Apple Computer, which introduced the Newton MessagePad in 1993. Shortly thereafter, several other manufacturers offered similar products. To date, PDAs have had only modest success in the marketplace, due to their high price tags and limited applications. However, many experts believe that PDAs will eventually become common gadgets. PDAs are also called palmtops, hand-held computers and pocket computers.

1.3.3 Basic Ideas and Terms

Data

Data is a name given to the facts that are supplied to the computer. It is then processed to obtain the desired output. In simple terms, data can be defined as the raw form of information. Typical data may not make sense to the user. It is only after processing that the data is transformed into something that is useful to the user. Thus, it can be said that data is different from information. As an example, in the operation to add two numbers A and B, the values *A*, *B* and the add operator (+) is data. The distinction is brought out more clearly with example 1.1.

Program

We know that the computer is a digital device. It is thus capable of understanding the digital signals. These signals are generated based on certain instructions that the user feeds into the computer. A program can be termed as the collection of such instructions. In example 1.1, the sequence of instructions that finally generates the bill for the purchase of a commodity is the program. A simple example of a program to add two numbers is as given as follows:

Input (A)

Input (B)

Add A to B

Assign value to C

In the steps given above, *Input* asks the user to enter the value of A and B. The computer then adds the value of A to the value of B and assigns the result to C. These four instructions are collectively called a program.

Information

Information can be termed as a more useful and intelligible form of data. A program operates on the data in a specified format and transforms it into information. For instance, in example 1.1 the bill that is produced after the user feeds in the data is the information.

Hardware

Hardware is the term used to define all the electronic and mechanical components found inside a computer system. These components are activated as required to execute the program. For instance, consider example 1.1. Here the counter person scans the code of the commodity and gets a printout of the bill. The scanner and the printer are two of the many hardware components that are used in the process.

Software

Consider a situation as in example 1.1. The counter person, to generate the bill, is using a set of programs. These programs are in turn executed by a set of underlying programs. These sets of programs are called software. Software can be broadly divided into two categories— application software and system software. *Application software* is the one that is created to cater to a specific task, for instance, generation of bills as in example 1.1. *System software* is that which runs the application software. It also provides an interface between the application software and the hardware thus enabling the application software to access the hardware units. It can, therefore, be said that system software runs the application software along with the hardware. The operating system is a very good example of system software.

Example 1.1

Consider a situation where a man needs to purchase three cans of mango juice. The man goes into a supermarket, picks up three cans of juice and brings them to the counter where the counter person scans the code given in the cans. After scanning, let us assume that the computer produces a result, which says *D20567, J002A, 3, $5.00,$15.00, $15.00, 11/11/05*. The counter person may find it difficult to understand (unless he is used to it). This is called data. Now, if the counter person uses a program that will take this data as input and generate a bill in the following format, it is said that the data is transformed into information. The entire process is explained in Figure 1.14.

Bill Number D20567					
Date of purchase: 11th Nov 2005					
Sl. No.	**Item Code**	**Item Name**	**Quantity**	**Rate**	**Amount**
1.	J002A	Daily Mango Juice Can	3.00	$5.00	$15.00
Total					**$ 15.00**

This bill is said to be information.

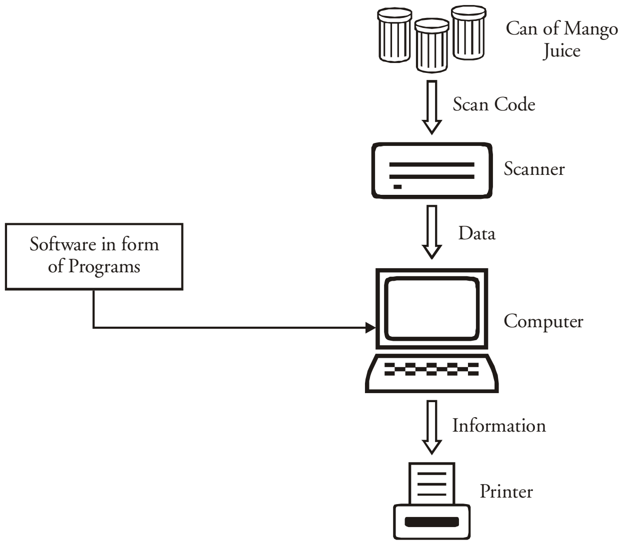


Figure 1.15 : Data, Program, Information, Hardware and Software

1.4 FUNCTIONAL UNITS

All computer systems have basically five functional units:

1. Input Unit
2. Output Unit
3. Memory and Storage Unit
4. Arithmetic and Logic Unit
5. Control Unit

1.4.1 Input Unit

The input unit provides an interface between the users and the machine, for inputting data and instruction etc. One of the most common examples is the keyboard. Data can be input in many more forms– audio, visual, graphical, etc.

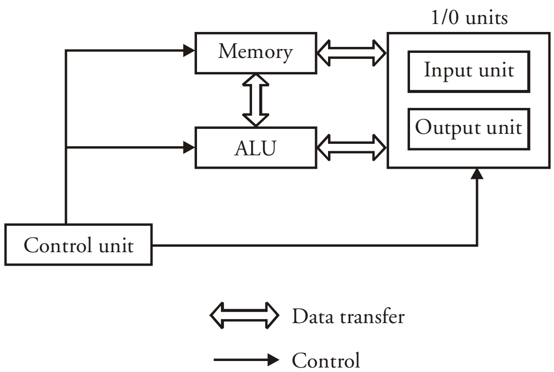


Figure 1.16 : Functional Units of the Computer System

Some common input devices are listed below:

- Keyboard
- Mouse
- Voice data entry
- Joy stick
- Light pen
- Scanner
- Secondary storage devices such as floppy disks, magnetic tapes, etc.

The data in any form is first digitized, i.e., converted into binary form, by the input device before being fed to the Central Processing Unit (CPU).

1.4.2 Output Unit

Like the Input devices, the Output devices also provide an interface between the user and the machine. A common example is the visual display unit (monitor) of a personal computer. The output unit receives the data from the CPU in the form of binary bits. This is then converted into a desired form (graphical, audio, visual etc.) understandable by the user.

Some common output devices are:

- Visual Display Unit (Monitor)
- Printers
- Speakers
- Secondary Storage Devices

The input and output unit collectively are referred to as ‘peripherals’.

1.5 COMPUTER LANGUAGES

Computer language may refer to:

1. **Programming language**, a formal language designed to communicate instructions to a machine, particularly a computer. A programming language is a formal language that specifies a set of instructions that can be used to produce various kinds of output. Programming languages generally consist of instructions for a computer. Programming languages can be used to create programs that implement specific algorithms.

The earliest known programmable machine preceded the invention of the digital computer and is the automatic flute player described in the 9th century by the brothers Musa in Baghdad, "during the Islamic Golden Age". From the early 1800s, "programs" were used to direct the behavior of machines such as Jacquard looms and player pianos.

2. **Command language**, a language used to control the tasks of the computer itself, such as starting other programs: A command language is a language for job control in computing.It is a domain-specific and interpreted language; common examples of a command language are shell or batch programming languages.

These languages can be used directly at the command line, but can also automate tasks that would normally be performed manually at the command line. They share this domain—lightweight automation—with scripting languages, though a command language usually has stronger coupling to the underlying operating system. Command languages often have either very simple grammars or syntaxes very close to natural language, to shallow the learning curve, as with many other domain-specific language

3. **Machine language** or machine code, a set of instructions executed directly by a computer's central processing unit: Machine code or machine language is a set of instructions executed directly by a computer's central processing unit (CPU). Each instruction performs a very specific task, such as a load, a jump, or an ALU operation on a unit of data in a CPU register or memory. Every program directly executed by a CPU is made up of a series of such instructions.

4. **Markup language**, a grammar for annotating a document in a way that is syntactically distinguishable from the text, such as HTML. A markup language is a system for annotating a document in a way that is syntactically distinguishable from the text. The idea and terminology evolved from the "marking up" of paper manuscripts, i.e., the revision instructions by editors, traditionally written with a blue pencil on authors' manuscripts.

In digital media this "blue pencil instruction text" was replaced by tags, that is, instructions are expressed directly by tags or "instruction text encapsulated by tags." Examples include typesetting instructions such as those found in troff, TeX and LaTeX, or structural markers such as XML tags. Markup instructs the software that displays the text to carry out appropriate actions, but is omitted from the version of the text that users see.

5**. Style sheet language,** a computer language that expresses the presentation of structured documents, such as CSS: A style sheet language, or style language, is a computer language that expresses the presentation of structured documents. One attractive feature of structured documents is that the content can be reused in many contexts and presented in various ways. Different style sheets can be attached to the logical structure to produce different presentations.

6. **Configuration language**, a language used to write configuration files. In computing, configuration files, or config files configure the parameters and initial settings for some computer programs. They are used for user applications, server processes and operating system settings.

7. **Construction language**, a general category that includes configuration languages, toolkit languages, and programming languages. Construction languages include all forms of communication by which a human can specify an executable problem solution to a computer. They include configuration languages, toolkit languages, and programming languages:

8. Configuration languages are languages in which software engineers choose from a limited set of predefined options to create new or custom software installations.

9. Toolkit languages are used to build applications out of toolkits and are more complex than configuration languages.

10. Scripting languages are kinds of application programming languages that supports scripts which are often interpreted rather than compiled.

11. Programming languages are the most flexible type of construction languages which use three general kinds of notation: Linguistic notations which are distinguished in particular by the use of word-like strings of text to represent complex software constructions, and the combination of such word-like strings into patterns that have a sentence-like syntax.

Formal notations which rely less on intuitive, everyday meanings of words and text strings and more on definitions backed up by precise, unambiguous, and formal (or mathematical) definitions.

12. Visual notations which rely much less on the text-oriented notations of both linguistic and formal construction, and instead rely on direct visual interpretation and placement of visual entities that represent the underlying software.

13. **Query language**, a language used to make queries in databases and information systems. Query languages are computer languages used to make queries in databases and information systems. Broadly, query languages can be classified according to whether they are database query languages or information retrieval query languages. The difference is that a database query language attempts to give factual answers to factual questions, while an information retrieval query language attempts to find documents containing information that is relevant to an area of inquiry

Modeling language, a formal language used to express information or knowledge, often for use in computer system design. A modeling language is any artificial language that can be used to express information or knowledge or systems in a structure that is defined by a consistent set of rules. The rules are used for interpretation of the meaning of components in the structure.

Hardware description language, used to model integrated circuits

1.6 MEMORY OR STORAGE UNIT

Memory system is at the heart of a computer system. It is the memory system that makes a computer what it is. The input data, the instructions necessary to manipulate the input data as also the output data are all stored in the memory.

Memory unit is an essential part of any digital computer because computer processes data only if it is stored somewhere in its memory. For example, if computer has to compute $f(x)=\sin x$ for a given value of x, then first of all x is stored in memory somewhere, then a routine is called that contains program that calculates sine value of a given x. It is an indispensable component of a computer.

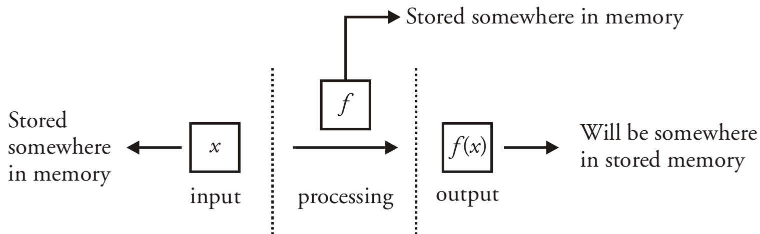


Figure 1.17 : Storage Unit

Since these memory devices are generally silicon chips containing several thousands of memory cells, it is not adequate to use a single memory. So there are types of memories used within the same computer system.

Storage Technologies

Various storage technologies have been developed making use of bi-stable properties of different objects. The most popularly employed technologies are briefed below:

Electrical Storage

These storage devices use the electronic charges (-ve and +ve) for the data and/or instruction storage. RAM, ROM, PROM and a host of other fast primary memories rely on this technology. Though they are fast, they have small capacity and high cost.

Magnetic Storage

Magnetic polarizations (North and South) of a magnetic substance are exploited for data and/or instruction storage in these types of memories. Most of the large capacity and relatively cheaper storage devices fall into this category such as floppy disk, hard disk, etc. to name a few.

Optical Storage

Optical storage devices use the fact that a light source (usually a laser beam) can burn holes on a disk that can be read back by reversing the source direction. CD-ROM disks employ this technology for data storage. Capacity of such devices is very high and the cost relatively very low.

Main Memory

Main memory is also known as primary memory. It is a faster memory. CPU directly communicates with main memory. Main memory contains all the data that is currently being processed by CPU. Its cost is higher than secondary memories because production of high speed memory employs sophisticated designing techniques.

Secondary Memory

Apart from main memory there is secondary memory too, which works slower than the main memory and is used to provide a backup. It is also called auxiliary memory. The main memory gathers the data required currently for processing and CPU uses this data.

Cache Memory

This is the smallest and fastest memory component in memory hierarchy of a digital computer. It increases the speed of processing. It is placed between the main memory and CPU.

It stores the data in advance, for processing in CPU. This way it increases the inflow of data to CPU, which is fast inherently.

Other Types of Memory

There are two types of memories:

1. Random Access Memory
2. Sequential Access Memory

The basic difference between the two memories is that first is random in nature, that is, the access of particular memory location doesn't depend upon the sequence, i.e., access time is small. But in sequential memory, the access of a particular data depends upon the location where it is stored.

For example, if a data is stored at XX40F then in sequential access the locations XX00 to XX40F will all be accessed, but in random access it takes same amount of time for each access.

Types of RAM

RAMs are of two types:

- **Static RAM:** Here refresh signal is not required. Data stored is lost as soon as power is switched off.
- **Dynamic RAM:** Here data stored may be lost even when power is on, so to maintain data one has to give refreshing signals.

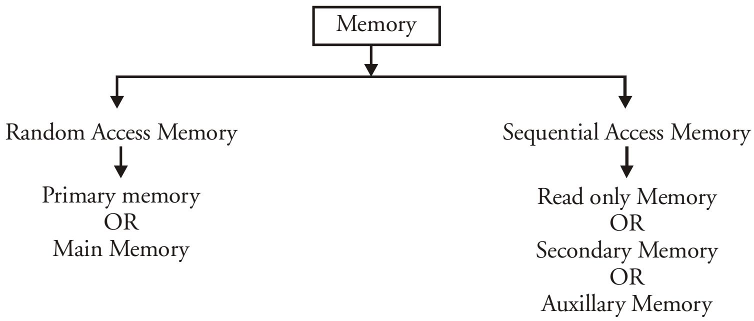


Figure 1.18 : Types of Memory

Arithmetic Logic Unit

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). Some processors contain more than one AU — for example, one for fixed-point operations and another for floating-point operations. (In personal computers, floating point operations are sometimes done by a floating point unit on a separate chip called a numeric coprocessor.)

Typically, the ALU has direct 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. 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. (For example, two operands might be added together or compared logically.) The format may be combined with the op code and tells, for example, whether this is a fixed-point or a floating-point instruction. The output consists of a result that is placed in a storage register and settings that indicate whether the operation was performed successfully. (If it isn't, some sort of status will be stored in a permanent place that is sometimes called the machine status word.)

In general, the ALU includes storage places for input operands, operands that are being added, the accumulated result (stored in an *accumulator*), and shifted results. The flow of bits and the operations performed on them in the subunits of the ALU is controlled by gated circuits. The gates in these circuits are controlled by a sequence logic unit that uses a particular algorithm or sequence for each operation code. In the arithmetic unit, multiplication and division are done by a series of adding or subtracting and shifting operations. There are several ways to represent negative numbers. In the logic unit, one of 16 possible logic operations can be performed — such as comparing two operands and identifying where bits don't match.

The design of the ALU is obviously a critical part of the processor and new approaches to speeding up instruction handling are continually being developed.

Control Unit

The control unit is the circuitry that controls the flow of information through the processor, and coordinates the activities of the other units within it. In a way, it is the "brain within the brain", as it controls what happens inside the processor, which in turn controls the rest of the PC.

The functions performed by the control unit vary greatly by the internal architecture of the CPU, since the control unit really implements this architecture. On a regular processor that executes ×86 instructions natively, the control unit performs the tasks of fetching, decoding, managing execution and then storing results. On a processor with a RISC core, the control unit has significantly more work to do. It manages the translation of ×86 instructions to RISC micro-instructions, manages scheduling the micro-instructions between the various execution units, and juggles the output from these units to make sure they end up where they are supposed to go. On one of these processors the control unit may be broken into other units (such as a *scheduling unit* to handle scheduling and a *retirement unit* to deal with results coming from the pipeline) due to the complexity of the job it must perform.

Check Your Progress 1
1. What are five basic operations performed by the computer system? …………………………………………………………………………………… …………………………………………………………………………………… 2. Draw the basic functional block diagram of the computer and explain in brief. …………………………………………………………………………………… ……………………………………………………………………………………

1.7 BASIC OPERATIONAL CONCEPT

A computer system can perform several operations but there are six basic operations that are performed by every computer system.

(i) A computer can receive information
(ii) A computer can put out information
(iii) A computer can perform arithmetic
(iv) A computer can assign a value to a variable or memory location
(v) A computer can compare two variables and select one of two alternative actions
(vi) A computer can repeat a group of actions.

(i) A computer can receive information

When a computer is required to receive information or input from a particular source, whether it be a keyboard, a disk or any other device, the verbs Read and Get are used in pseudocode. Read is usually used when the algorithm is to receive input from a record on a file, while Get is used when the algorithm is to receive input from the keyboard.

Example:

- Read student name (from the student master file).
- Get system date (from the computer system).
- Read student ID number.
- Get order.

(ii) A computer can put out information

When a computer is requested to supply information or output to a device, the verbs Print, Write, Put, Output or Display are used in pseudocode. Print is used to send the output to the printer, while Write is used for writing to a file. For putting the information to a screen, the common keywords are Put, Display or Output.

Example:

- Print "End of the Output"
- Write student record to master file
- Put out name, address and post code
- Output grade; Display "an input error occurred, please re-enter."

(iii) A computer can perform arithmetic

- A programmer may use actual mathematical symbols or the words for those symbols.
- For example:
  - "Add score to total_score" is same as "total_score = total_score + score" (programming languages use mathematical equations to assign values to memory locations. In this case, a new value of total_score is assigned to a memory location named total_score by adding score to the current (not new) value of total_score).

- The following symbols can be used in pseudocode: + for Add, - for Subtract, * for Multiply, / for Divide, ( ) for Parentheses.
- For more example:
  - Divide total_score by student_count
  - class_average = total_score / student_count
  - Compute C = (F - 32) * 5 / 9

When writing mathematical calculation for the computer, the order of operation should be considered; otherwise you may end up with incorrect values.

- The order of operators are following:
  - **( ) :** Values within parentheses are always evaluated first. Ex:
  - **^ :** Exponentiation (raising a number to a power) is second. Ex:
  - **– :** Negation (creating a negative number) is third. Ex:
  - *** and / :** Multiplication or division is fourth. Ex:
  - **\ :** Integer division (a.k.a. Div) is fifth. Ex:
  - **Mod:** Remainder division is sixth. Ex:
  - **+ or – :** Addition and subtraction are last.

  Example: For an expression Total = 10 + 15 * 2 / 4 ^ 2 –(2 + 3) , the order of computation is following:
  - Total = 10 + 15 * 2 / 4 ^ 2 **–(2 + 3)**
  - Total = 10 + 15 * 2 / **4 ^ 2 –**(5)
  - Total = 10 + 15 * 2 / 16 **–(5)** (5 as a negative value)
  - Total = 10 + **15 * 2** / 16 **–** 5
  - Total = 10 + **30 / 16 –** 5
  - Total = **10 + 1.875** – 5
  - Total = **11.875 – 5**
  - Total = 6.875

(iv) A computer can assign a value to a variable or memory location

There are three cases where you may write pseudocode to assign a value to a variable or memory locations:

1. To give data an initial value. The verbs Initialize or Set are used.
2. To assign a value as a result of some processing, the symbol " = " is used.
3. To keep a piece of information for later use, the verbs Save or Store is used.

Example:

- Initialize total_score to 0: total_score = 0
- Set student_count to 0: student_count = 0
- total_score = total_score + score1

- student_count = student_count + 1
- class_average = total_score / student_count
- Store class_average in class_average_quiz1

(v) A computer can compare two variables and select one of two alternative actions

- For this operation, special keywords are used: **If..Then** or **If..Then..Else**.
- The comparison of data is established in the If clause, and the choice of alternatives is determined by the Then or Else options. Only one of these alternatives will be performed.

Example:

If student is part_time Then

add 1 to part_time_count

Else

add 1 to full_time_count

EndIf

If the student is a part-time student, then "add 1 to part_time_count" is performed. Otherwise, the computer skips to the Else clause to perform "add 1 to full_time_count" instruction.

(vi) A computer can repeat a group of actions

When there is a sequence of processing steps that need to be repeated, keywords Do While and EndDo, are used. And processing stems in between those keywords should be repeated as long as the condition for initiation is met.

Example:

Do While student_total < 30

Read student record

Print student name, address

Add 1 to student_total

EndDo

In this example, the set of instruction in the do while loop will be performed repeatedly as long as student_total is less than 30. And each time computer goes through the loop, the value of student_total will be incremented by 1, in which eventually will make the student_total to be equal to 30, and terminate the loop

1.8 BUS STRUCTURES

A bus, in computing, is a set of physical connections (cables, printed circuits, etc.) which can be shared by multiple hardware components in order to communicate with one another.

The purpose of buses is to reduce the number of "pathways" needed for communication between the components, by carrying out all communications over a single data channel. This is why the metaphor of a "data highway" is sometimes used.

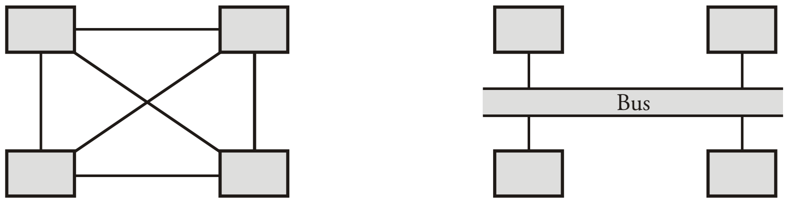


Figure 1.19 : Bus Structure

If only two hardware components communicate over the line, it is called a hardware port (such as a serial port or parallel port).

1.8.1 Characteristics of Buses

A bus is characterised by the amount of information that can be transmitted at once. This amount, expressed in bits, corresponds to the number of physical lines over which data is sent simultaneously. A 32-wire ribbon cable can transmit 32 bits in parallel. The term "**width**" is used to refer to the number of bits that a bus can transmit at once.

Additionally, the bus speed is also defined by its **frequency** (expressed in Hertz), the number of data packets sent or received per second. Each time that data is sent or received is called a **cycle**.

This way, it is possible to find the maximum **transfer speed** of the bus, the amount of data which it can transport per unit of time, by multiplying its width by its frequency. A bus with a width of 16 bits and a frequency of 133 MHz, therefore, has a transfer speed equal to:

$$16 \times 133 \times 10^6 = 2128 \times 10^6 \text{ bit/s}$$

or $$2128 \times 10^6/8 = 266 \times 10^6 \text{ bytes/s}$$

or $$266 \times 10^6/1000 = 266 \times 10^3 \text{ KB/s}$$

or $$259.7 \times 10^3/1000 = 266 \text{ MB}$$

1.8.2 The System Bus Architecture

In computer architecture, a bus is a sub system that transfers data between computer components inside a computer or between computer. The flowchart of bus architecture is shown in Figure 1.19.

1.8.3 The Bus sub-assembly

In reality, each bus is generally constituted of 50 to 100 distinct physical lines, divided into three sub-assemblies:

The **address bus** (sometimes called the *memory bus*) transports memory addresses which the processor wants to access in order to read or write data. It is a unidirectional bus.

The **data bus** transfers instructions coming from or going to the processor. It is a bidirectional bus.

The **control bus** (or *command bus*) transports orders and synchronisation signals coming from the control unit and travelling to all other hardware components. It is a bidirectional bus, as it also transmits response signals from the hardware.

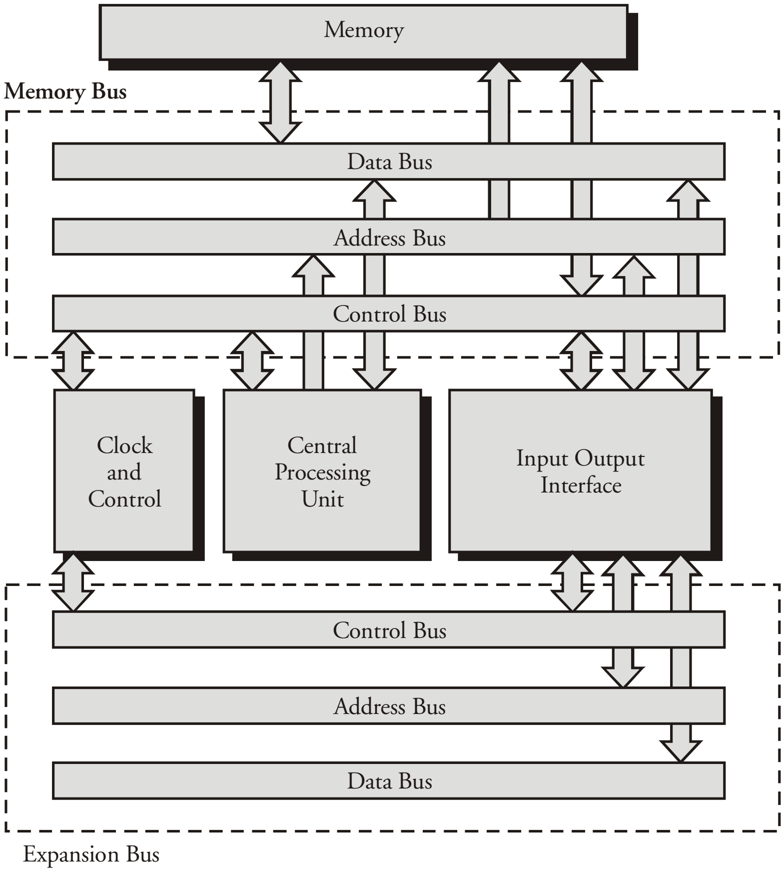


Figure 1.20 : Typical System Bus Architecture

1.8.4. The Primary Buses

There are generally two buses within a computer – internal bus and expansion bus:

The **internal bus** (sometimes called the *front-side bus*, or *FSB* for short). The internal bus allows the processor to communicate with the system's central memory (the **RAM**).

The expansion bus (sometimes called the *input/output bus*) allows various motherboard components (USB, serial, and parallel ports, cards inserted in PCI connectors, hard drives, CD-ROM and CD-RW drives, etc.) to communicate with one another. However, it is mainly used to add new devices using what are called **expansion slots** connected to the input/outpur bus.

Other Buses

The ISA Bus: The original version of the **ISA bus** that appeared in 1981 with PC XT was an 8-bit bus with a clock speed of 4.77 MHz.

In 1984, with the appearance of PC AT (the *Intel 286* processor), the bit was expanded into a 16-bit bus and the clock speed went from 6 to 8 MHz and finally to 8.33 MHz, offering a maximum transfer rate of 16 Mb/s (in practice only 8 Mb/s because one cycle out of every two was used for addressing).

The ISA bus permitted **bus mastering,** i.e. it enabled controllers connected directly to the bus to communicate directly with the other peripherals without going through the processor. One of the consequences of *bus mastering* is **Direct Memory Access (DMA).** However, the ISA bus only allows hardware to address the first 16 megabytes of **RAM**.

The MCA Bus: The **MCA bus** is an improved proprietary bus designed by IBM in 1987 to be used in their PS/2 line of computer. This 16 to 32-bit bus was incompatible with the ISA bus and could reach a throughput of 20 Mb/s.

The EISA Bus: The **EISA bus** was developed in 1988 by a consortium of companies (AST, Compaq, Epson, Hewlett-Packard, NEC, Olivetti, Tandy, Wyse and Zenith) in order to compete with the MCA proprietary bus that was launched by IBM the previous year. The EISA bus used connectors that were the same size as the ISA connector but with 4 rows of contacts instead of 2, for 32-bit addressing.

The EISA connectors were deeper and the additional rows of contacts were placed below the rows of ISA contacts. Thus, it was possible to plug an ISA expansion board into an EISA connector. However, they did not plug as deep into the connector (because of the bezels) and thus only used the top rows (ISA) of contacts.

1.9 ⊠R⊠⊠E⊠⊠⊠R ⊠ERF⊠RM⊠⊠⊠E -⊠

Considering how important it is, the value of a processor is measured using surprisingly few parameters. Since most processors work in a similar fashion and have similar external characteristics (i.e., in terms of how a user would see them) the most important question becomes: "how fast does it run?" This is a very fair question to focus on, because while the internal details of how the processor works are interesting, what really counts to the computer user is the performance level of the processor in question.

Processor performance factor:

Since the performance of a processor is (in most cases) based on how many instructions it can execute in a given time, it has become common to use the words "performance" and "speed" somewhat interchangeably. Unfortunately, the word "speed" has too many meanings when it comes to processors, and as a result frequently one person will use it to mean one thing and another person to mean quite another.

There are two major factors that determine the performance level of a processor:

- **Clock Speed:** The processor's clock speed is a measure of how fast it is running in raw terms, meaning, how many clock cycles it has to work within a given period of time. Using the analogy of a bicycle, this would be equivalent to how *fast* you are pedalling.

- **Architecture:** The internal design and architecture of the processor measures how efficiently the processor does its work and how much it does with each clock cycle. In the bicycle analogy, this would be a measure of how *hard* you are pedaling.

1.9 The Processor Clock

Every processor has its own built-in clock, this clock dictates how fast the processor can process the data (0's and 1's). You will see processors advertised as having a speed of say 2GHz, this measurement refers to the internal clock.

If a processor is advertised as having a speed of 2GHz, this means that it can process data *internally* 2 billion times a second (every clock cycle). If the processor is a 32-bit processor running at 2GHz then it can *potentially* process 32 bits of data simultaneously, 2 billion times a second !!

Since clock speed is easy to see and understand—it's just a number—and architecture is both complex and difficult to understand. It is not surprising that the former receives much more attention than the latter. This is unfortunate, because looking at just the clock speed of a processor is very deceptive, because it tells only one part of the picture. In fact, this is more so today than ever before due to the much greater variety in processor designs and technologies. The "P" rating scheme was invented by Intel competitors AMD and Cyrix to provide what they feel is an assessment of the value of their processors that is more fair than using just clock speed.

Check Your Progress 2
Fill in the blanks: 1. A computer can perform ……………………………. 2. A bus, in computing, is a set of ………………connections 3. The ………………. transports memory addresses. 4. The ISA bus permitted ………………… 5. The MCA bus stands for …………………………

1.10 PROCESSOR PERFORMANCE

It is important to remember that the processor is not the only component in the system that determines overall system performance. But it is not the only one. Many hardware companies like to overstate the value of the processor's performance (sometimes focusing just on the clock speed). For example, you'll see claims that a system running with a Pentium 150 is "50% faster" than one with a Pentium 100. Or a retailer will try to sell you a 120 MHz Pentium OverDrive for your Pentium 60 system with claims that it will "double performance". These claims are, in almost every case, totally untrue. In fact, they are usually nowhere close to being true.

The reason is that speeding up the processor only improves system performance for those aspects of system use that depend on the processor. In most systems, the processor is already fast enough, but it is other parts of the system—the memory, system buses, hard disk and video card especially—that are the "bottlenecks" to system performance. Since most processors are already much faster than the devices that support them, they spend a great deal of time waiting around for data that they can use. Putting a still faster processor in place of the current one will not yield a very large performance increase if this is the case, because the faster processor will just spend more time waiting.

One of the most important factors that influences overall system performance is memory bus speed. The availability of Pentium PCs with both 60 and 66 MHz system bus speeds has emphasized this. Since the processors on these machines are so fast, they end up waiting a great deal on data from the memory bus. As a result, a slower processor running on a 66 MHz system bus can provide comparable performance to a faster one on a 60 MHz bus.

[illegible] Basic Performance Equation

Why is my computer fast (or slow)?

Would it help to improve?

CPU Performance equation is one way to start answering these questions.

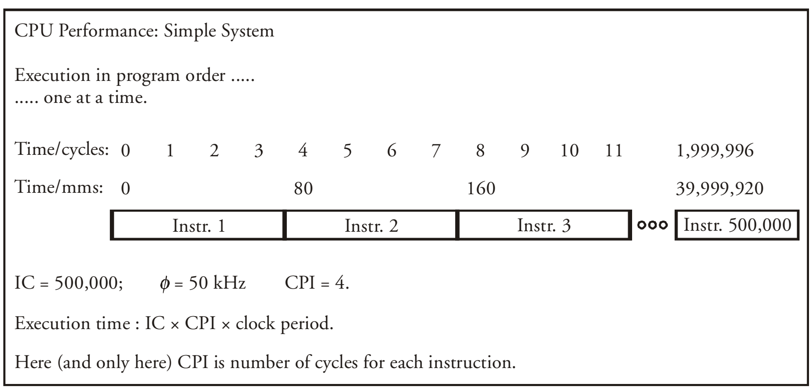
CPU Performance decomposed into three components:

- **Clock Frequency (f)**
  Determined by technology and influenced by organization.
- **Clocks per Instruction (CPI)**
  Determined by ISA, microarchitecture, compiler, and program.
- **Instruction Count (IC)**
  Determined by program, compiler, and ISA.

These combined to form CPU Performance Equation

$$t_T = \frac{1}{\phi} \times CPI \times IC$$

Where *tT* denotes the execution time.



[illegible]0[illegible] [illegible]c k R[illegible]e

The **clock rate** is the fundamental rate in *cycles per second* (measured in hertz) for the frequency of the clock in any synchronous circuit. For example, a crystal oscillator frequency reference typically is synonymous with a fixed sinusoidal waveform, a clock rate is that frequency reference translated by electronic circuitry (AD Converter) into a corresponding square wave pulse [typically] for digital electronics applications. In this context, the use of the word, speed (physical movement), should *not* be confused with frequency or its corresponding clock rate. Thus, the term "clock speed" is a misnomer.

A single clock cycle (typically shorter than a nanosecond in modern non-embedded microprocessors) toggles between a logical zero and a logical one state. Historically, the logical zero state of a clock cycle persists longer than a logical one state due to thermal and electrical specification constraints.

CPU manufacturers typically charge premium prices for CPUs that operate at higher clock rates. For a given CPU, the clock rates are determined at the end of the manufacturing process through actual testing of each CPU. CPUs that are tested as complying with a given set of standards may be labelled with a higher clock rate, e.g., 1.50 GHz, while those that fail the standards of the higher clock rate yet pass the standards of a lesser clock rate may be labeled with the lesser clock rate, e.g., 1.33 GHz, and sold at a relatively lower price.

Limits

The clock rate of a CPU is normally determined by the frequency of an oscillator crystal. The first commercial PC, the Altair 8800 (by MITS), used an Intel 8080 CPU with a clock rate of 2 MHz (2 million cycles/second). The original IBM PC (c. 1981) had a clock rate of 4.77 MHz (4,772,727 cycles/second). In 1995, Intel's Pentium chip ran at 100 MHz (100 million cycles/second), and in 2002, an Intel Pentium 4 model was introduced as the first CPU with a clock rate of 3 GHz (three billion cycles/second corresponding to ~3.3 10^{-10}seconds per cycle).

With any particular CPU, replacing the crystal with another crystal that oscillates half the frequency ("underclocking") will generally make the CPU run at half the performance. It will also make the CPU produce roughly half as much waste heat. Conversely, some people try to increase performance of a CPU by replacing the oscillator crystal with a higher frequency crystal ("overclocking"). However, the amount of overclocking is limited by the time for the CPU to settle after each pulse, and by the extra heat created.

After each clock pulse, the signal lines inside the CPU need time to settle to their new state. That is, every signal line must finish transitioning from 0 to 1, or from 1 to 0. If the next clock pulse comes before that, the results will be incorrect. Chip manufacturers publish a "maximum clock rate" specification, and they test chips before selling them to make sure they meet that specification, even when executing the most complicated instructions with the data patterns that take the longest to settle (testing at the temperature and voltage that runs the lowest performance).

Also, some energy is wasted as heat (mostly inside the driving transistors) whenever a signal line makes a transition from the 0 to the 1 state or vice versa. When executing complicated instructions that cause many transitions, higher clock rates produce more heat. If electricity is converted to heat faster than a particular computer cooling system can remove it, then the transistors may get hot enough to be destroyed.

Engineers continue to find new ways to design CPUs that settle a little quicker or use slightly less energy per transition, pushing back those limits, producing new CPUs that can run at slightly higher clock rates. The ultimate limits to energy per transition are explored in reversible computing, although no reversible computers have yet been implemented.

1.10 Performance Measurement

The processor performance can be measured in many ways. The most common metric is the time required for a processor to accomplish a defined task. On the other hand, memory usage and energy consumption may be equally or even more important in some applications. This paper will examine all three of these metrics, with a focus on execution time.

Measuring DSP processor performance in a way that allows fair comparisons between processor families is difficult. Furthermore, performance measurements are only useful to the typical engineer if the measurements can be related to the requirements of particular applications. To address these challenges, Berkeley Design Technology, Inc. (BDTI) uses a two-fold methodology of algorithm kernel benchmarking and application profiling.

The processor's clock speed is a measure of how fast it is running in raw terms, meaning, how many clock cycles it has to work with in a given period of time. Using the analogy of a bicycle, this would be equivalent to how *fast* you are pedalling.

One of the most important factors that influences overall system performance is memory bus speed. The availability of Pentium PCs with both 60 and 66 MHz system bus speeds has emphasized this. Since the processors on these machines are so fast, they end up waiting a great deal on data from the memory bus. As a result, a slower processor running on a 66 MHz system bus can provide comparable performance to a faster one on a 60 MHz bus.

The classical example here is the Pentium 133, which provides performance virtually identical to the Pentium 150 in most cases. In fact, the Pentium 150 scores *below* the Pentium 133 in some benchmarks. Another way to look at this: setting a Pentium 100 to run with a memory bus speed of 50 MHz and a clock multiplier of 2 will result in a significant decrease in system (not processor) speed compared to its normal setting of 66 MHz and clock multiplier of 1.5, even though in both cases the CPU is running at 100 MHz.

[illegible] M [illegible]

The computer can be defined as a data manipulating digital electronic device. The evolution of computers is explained in terms of the *generation of computers*. Computers in each generation have better capabilities and features than those in the previous generations.

There are four components of the computer: Input, Storage, Processing, Output.

Devices that are under the direct control of the computer are said to be connected online. Input-output interface provides a method for transferring information between internal storage and external I/O devices. The I/O bus consists of data lines, address lines and control lines. There are three ways that computer buses can be used to communicate with memory and I/O: Use two separate buses, one for the memory and the other for I/O. Use one common bus for both memory and I/O but have separate control lines for each. Use one common bus for memory and I/O with common control lines. In serial transmission mode, data are transferred bit-by-bit basis. It hardly matters what type of device and what medium we are using more than one bit are transferred at a time and this type of transfer is known as parallel communication. Every I/O activity is initiated by I/O instruction written in the code. An interrupt generated internally by CPU is sometimes termed as trap. Tightly Coupled System: In this, the tasks and/or processors communicate in a highly synchronized fashion. It communicates through a common shared memory system. Synchronization is communication of control information between processors to enforce the correct sequence of processes and to ensure mutually exclusive access to shared writable data.

ACTIVITY

Which bus architecture is used today in the modern digital computer? Discuss them in brief.

KEYWORDS

CPU: Central Processing Unit

MCA bus: Micro Channel Architecture

EISA bus: Extended Industry Standard Architecture

ISA bus: Industry Standard Architecture

DMA: Direct Memory Access

Review Exercise

Descriptive Questions

1. Differentiate between minicomputer and microcomputer.
2. What do you understand by the fourth generation of computer systems?
3. The basic architecture of a computer system can be divided into four major components, what are those?
4. What is the difference between primary and secondary storage devices?
5. What is the process of processor clock?

6. What operations are performed by ALU?

7. What is the difference between processor clock and clock rate?

Multiple Choice Questions

1. The input unit of a computer
(a) feeds the data in CPU (b) retrieves the data from CPU
(c) directs all other units (d) all of these

2. The heart of any computer is
(a) CPU (b) Memory
(c) I/O unit (d) Disks

3. The control unit of computer
(a) performs ALU operations on the data
(b) controls the operation of the output devices
(c) is a device for manually operating the computer
(d) directs the other unit of computer.

4. Which of the following is responsible for coordinating various operating using timing signals?
(a) ALU (b) control unit
(c) memory unit (d) I/O unit

5. The main memory of computer is
(a) ERAM (b) ROM
(c) RAM (d) EPROM

6. The computer memory which is empty is
(a) RAM (b) ROM
(c) Floppy disk (d) Mouse

Ans. 1. (a) 2. (a) 3. (d) 4. (b) 5. (c) 6. (b)

True and False Questions

1. A single clock cycle toggles between a logical zero and a logical one state. (T/F).

2. CPU Performance Decomposed into six Components. (T/F).

3. The clock rate of a CPU is normally determined by the frequency of an oscillator crystal. (T/F).

4. ALU includes storage places for input operands. (T/F).

5. A computer system is made up of a number of software devices. (T/F).

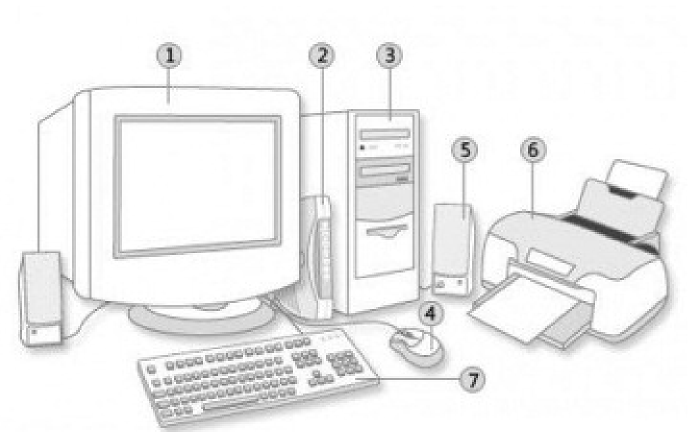
Fill in the Blanks

1. These storage devices use the ___________ (-ve and +ve) for the data and/or instruction storage.
2. Each clock pulse, the signal lines inside the CPU need ___________ to settle to their new state.
3. The purpose of buses is to reduce the number of ___________ needed for communication.
4. ___________ data stored is lost as soon as power is switched off.
5. ___________ memory is also known as primary memory.
6. A bus with a width of 64 bits and a frequency of 103 MHz, therefore, has a transfer speed?
7. Compute expression Total = 16 + 13 * 2 / 4 ^ 2 – (8 + 11).

Check Your Progress 1
1. a. A computer can receive information b. A computer can put out information c. A computer can perform arithmetic d. A computer can assign a value to a variable or memory location e. A computer can repeat a group of actions

LIST OF PRACTICALS

1. Identify the different part of computer system and peripherals indicated by the numbers.



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