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Categories of computers



When we think of computers today, a laptop or a tablet computer comes to our mind. Computers can be classified into separate categories based on their size and processing power. Today, we have computers that fit to our palm, with more processing power.

Classification of computers based on their size

We now look at the classification of computers based on their size.

- Supercomputer
- Mainframe computer
- Minicomputer
- Microcomputer
- Mobile computer

Supercomputer

Supercomputers are the most powerful computers. They are huge in size and often occupy a whole room. They have high processing speed. They are measured in **FLOPS (Floating Operations Per Second)**. The modern supercomputers run hundreds of thousands of processors and are capable of computing quadrillions of calculations in just a few nanoseconds.



Quadrillion means 10^{15} .



Pratyush supercomputer



The supercomputers are mostly used in applications that carry out more complex tasks. The applications that rely on supercomputers for computations are modelling molecular structures, weather forecasting and quantum mechanics. These applications use supercomputer for their intense processing power to solve their tedious equations.

India's fastest supercomputers are **Pratyush** and **Mihir**. They run at a maximum speed of 6.8 PetaFlops. They were mainly developed for the purpose of weather forecast and climate change.

Examples: CRAY series, PARAM (developed in India), Titan, FUJITSU.



Tech facts

Pratyush and Mihir supercomputers were established at the Indian Institute of Tropical Meteorology (IITM), Pune and National Centre for Medium Range Weather Forecast (NCMRWF).

Mainframe computer

These computers are huge towering machines with lots of processing power. The processing capabilities of these computers are measured in **MIPS (Millions of Instructions Per Second)**. The mainframe computers are widely used by banks and government agencies. They store large quantities of information, but have processing capabilities lesser than the supercomputers.

Examples: IBM 370, IBM 3000 series, UNIVAC 1180, Burroughs B 7900



IBM Z/Os Mainframe computer

Minicomputer

A minicomputer can support about 200 users at the same time. It is a multiprocessing machine. The size of a minicomputer resembles the size of a refrigerator. It is less powerful than mainframes. A server can be a minicomputer, but not all servers are minicomputers. They are referred to as small or mid-size servers. They cannot be used as personal computer. Minicomputers are widely used for scientific and engineering computations, file handling, business transactions and database management.

Examples: CDC 160 series, DEC PDP and VAX series, Varian 620 100 series



DEC Minicomputer

Microcomputer

The microcomputers are small computers that run on microprocessors. A microprocessor is a processor, whose components namely input, output and CPU are embedded on a single integrated chip. They have a single user support. It has less data storage. Even though, they are small computers, the range capabilities are vast. Students use microcomputers for Word processing. They are used for teaching, DTP (Desktop Publishing), statistical analysis and graphics.

Example: Microcomputers of both tower model and desktop model



(a) Microcomputer - Tower model



(b) Microcomputer - Desktop model

Mobile computer

Mobile computers are those which can be carried around and taken from place to place. If a desktop computer is a microcomputer, then a laptop is a mobile computer. These computers are super small and mobile.

The list of devices that are categorised as mobile computers are:

- **Laptops:** They are portable computers that can be taken elsewhere. The components are contained inside a panel that functions as keyboard. The screen is attached with the keyboard that can be folded. Today, the laptops are a better replacement for the desktop computers, because of their size and convenience.
- **Tablets:** These are flat and do have a keyboard or mouse attached to it. Touch screen functionality is used for navigation.
- **Handheld game console:** These are tiny computers on which people play games on the go. Devices like the Game Boy, Sega Nomad, PlayStation Portable (PSP) and PlayStation Vita are few examples of handheld game consoles.





(a) Handheld game console

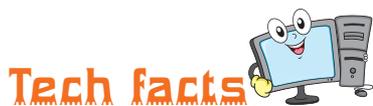


(b) Few mobile computers

- **Portable media players:** These are small electronic devices that store and play audio. They are also called as MP3 players. iPod is a mobile computer that fall under the category of portable media player.
- **Cell phones and smartphones:** These are communicating devices that have all the features of a computer. Few devices have keyboard. But a majority uses touch screen facility. We can make audio and video calls. We can send and receive e-mails. All transactions can be done with a smartphone. The iPhone and Samsung Galaxy are few examples of powerful smartphones.

Game consoles

Game consoles are interactive multimedia, which is used for entertainment. They are predefined programs. The game contains manipulative images with sounds generated by a video game console. It can be displayed on a television screen or a computer monitor. It is a simulated and structured game with defined instructions and rules. Today, the computer gaming industry is one of the most profitable industry in the world. The important aspect is the rise of the video game console. Game consoles are classified as home consoles and handheld consoles.



In 1951, Ralph H. Baer was the first person to propose the idea of a home video game.

Tic-tac-toe was one of the first popular game played on the analog computers. Like for computer generation, we have generations for game consoles. Some of the popular home consoles of second generation were **Fairchannel F**, **Magnavox Odyssey2** and **Atari 5200**.





Fairchannel F



Magnavox Odyssey2



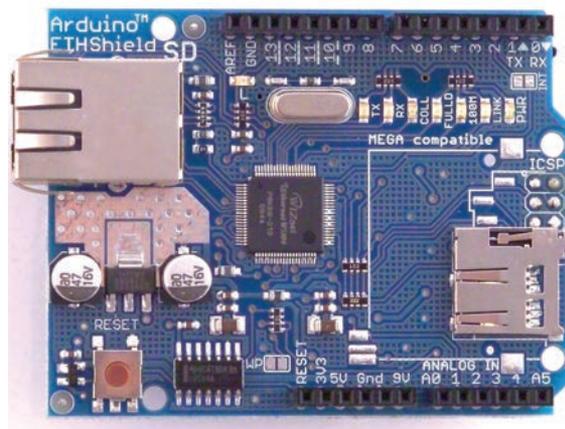
Atari 5200

The first handheld game console was the **Microvision**, which was designed by Smith Engineering and sold by Milton-Bradley in 1979. It came with interchangeable cartridges, small and fragile LCD display and had a narrow space for selecting games. It was discontinued in the year 1981.

Currently, the gaming console is in the eighth generation, incorporated with new high-precision computer games like **Fifa**. Video games now come with 3D technology incorporated in it. This creates a lively feeling for the game lovers, when they play. The joystick and controllers are the handheld devices that are used for interaction. The sounds are generated by the speakers and the interactive visuals are generated by the VDUs or monitors. These devices have the instructional manual written in the hardware and gets loaded with multiplayer support. Some common examples of game consoles are **Sony PlayStation 3**, **Microsoft Xbox 360** and **Nintendo Wii**.

Embedded computers

An embedded computer is a system that is pre-programmed and controlled by the operating system. It contains large amount of electrical and mechanical system with real-time computing. These computers are programmed using the RTOS (Real-Time Operating System) programming. These computer systems have the capability to control many devices. Almost 98 per cent of microprocessors are manufactured as embedded system components. Modern embedded computing systems are based on microcontrollers.



Microcontroller

Tech corner



A microcontroller is a small computer on a single integrated circuit, which contains one or more CPUs, input-output peripherals and memory.

Characteristics of embedded computers

- They are programmed to do only specific tasks.
- They are pre-programmed on a single chip and placed inside an operating mechanical or electrical device.
- RTOS (Real-Time Operating System) is used in embedded computers.
- The program is burnt into a ROM chip and the user cannot install own application software into it.
- They fall under FIRMWARE category.
- These computers are constructed using microcontrollers.

Advantages of embedded computers

- Less complicated in design and functions efficiently making it easy to maintain.
- They are small in size and cost effective.
- They do not perform redundant programming.
- They are user-friendly.

Disadvantages of embedded computers

- They are meant only for very specific use.
- Their functions are limited.
- Servicing the system becomes complicated, as they are placed inside a device. Hence, problems should be rectified at the design stage itself.

Examples of appliances using the embedded technology are microwave ovens, washing machines, smartphones, cars, television and air-conditioning remote controls, lifts, escalators, GPS systems, etc.

Embedded computers play a key role in the Internet of Things (IoT) that connect machines, places, people to the cloud computing.



Tech corner



The Internet of Things (IoT) is a system of interrelated digital, mechanical and computing devices, animals or people and objects which transfer data over a network without any human or computer intervention using the unique identifiers (UIDs) provided to them.

Let us revise



- Computers can be classified into separate categories based on their size and processing power.
- The classifications of computers based on their size are: Supercomputer, mainframe computer, minicomputer, microcomputer and mobile computer.
- Supercomputers are huge in size and are measured in FLOPS (FLoating Point Operations Per Second). Windows Media Player organises media files (both audio and video) on a computer.
- Mainframe computers are huge towering machines with lots of processing power and are measured in MIPS (Million Instructions Per Second). Windows Explorer is the operating system's file and folder manager.
- A minicomputer can support about 200 users at the same time. They are referred to as small or mid-size servers.
- The microcomputers are small computers that run on microprocessors.
- Mobile computers are those which can be carried around and taken from place to place.
- Game consoles are interactive multimedia, which is used for entertainment. They are predefined programs. The game contains manipulative images with sounds generated by a video game console.
- An embedded computer is a system that is pre-programmed and controlled by the operating system.
- Modern embedded computing systems are based on microcontrollers.

Quick check



A. Fill in the blanks.

1. India's fastest supercomputers are _____ and _____ .
2. A minicomputer can support about _____ users at the same time.
3. _____ are tiny computers on which people play games on the go.
4. Embedded computers are programmed using the _____ programming.

B. Match the type of computer to the correct examples.

- | | |
|------------------------------|---------------------|
| 1. Minicomputer | a. desktop computer |
| 2. Mainframe computer | b. microwave oven |
| 3. Microcomputer | c. CDC 160 series |
| 4. Embedded computer | d. UNIVAC 1180 |

C. State whether the given statements are True (T) or False (F).

1. Laptops are portable and can be carried elsewhere.
2. Microcomputers are referred to as mid-size computers.
3. Embedded computers are programmed to do only specific tasks.
4. Supercomputers provide interactive multimedia.



Question time



A. Choose the correct answer.

1. Which of these computers are widely used in banks and government agencies?

- a. supercomputers b. mainframes c. minicomputers
 d. microcomputers

2. These computers fall under FIRMWARE category.

- a. game consoles b. supercomputers c. minicomputers
 d. embedded computers

3. This was one of the first popular games played on the analog computers.

- a. Tic-tac-toe b. Atari 5100 c. Fairchannel F
 d. Fifa

B. Answer the following questions.

- How are the computers classified based on their size?
- Write a note on the supercomputers.
- Discuss mainframe computers.
- Differentiate minicomputers and microcomputers.

Minicomputers	Microcomputers

5. How are mobile computers categorised?
6. Explain briefly about game consoles.
7. Describe the embedded computers in detail.

Think beyond



Do you think that as the size of the computers decrease, there is complexity in the design? Justify.

Tips for teachers



Take few pictures of different categories of computers to the class. Explain the students about their characteristics. To make the class interesting, show some pictures of computers that do only specific tasks and ask the students to answer to which category they belong to. Make the class more interactive. Recapitulate the concepts by conducting quiz among the students.

Refer more



<https://blog.udemy.com/categories-of-computer/>



Computer language



We use computer languages to communicate with computers. They are in the form of instructions.

The language used to communicate with a computer is called a **programming language**.

The set of instructions given to a computer to do a specific task is called a **program**. The person who writes program using any programming language is called a **programmer**.

Types of computer languages

Computer languages are broadly classified into four types:

- Machine language
- Assembly language
- High-level language
- Fourth Generation language (4GL)

The programs vary between different computers.

Example: First generation computers

Machine language

We know that a computer understands only the machine language. It is expressed in binary digits of 0s and 1s. It depends on the hardware that requires a different set of binary instructions for different types of computer hardware. The main benefits are: high speed and low memory usage. It is difficult to write programs in machine language.

Assembly language

This is a low-level language which uses **mnemonic codes** instead of 0s and 1s. Some of the mnemonics are: **SUB, ADD, MOV**, etc.

10111001	00000000
11010010	10100001
00000100	00000000
10001001	00000000
00001110	10001011
00000000	00011110
00000000	00000010
10111001	00000000
11100001	00000011
00010000	11000011
10001001	10100011
00001110	00000100
00000010	00000000

Machine language



Since a computer can only understand the machine language, we need a translator called **assembler** to convert the assembly language program into the machine language program.

Example: Second generation computers

The machine and assembly languages are called low-level languages as they are **machine-dependent**, since the programs vary from one system to another.

High-level language

High-level languages use English-like statements. They are easy to learn and require less time to write. Some examples of high-level languages include **BASIC, FORTRAN, C, C++**.

Programs written in high-level languages can be translated into machine languages and can run on any computer by using an appropriate translator. These programs are easy to write, modify and maintain. They are **machine-independent**.

Example: Third generation computer.

Type 1(MASM)

```
.model small
.data
    Mes db 'Hello $'
    Op1 db 20h
    Op2 db 30h
.code
Start:
    Mov ax,@data
    Mov ds,ax
    Mov ax,op1
    Mov bx,op2
    Add ax,bx
    Int 3
End start
```

Assembly language

```
1 import java.util.Scanner;
2
3 public class Hello
4 {
5     public static void main(String[] args)
6     {
7         System.out.print("Please enter your name: ");
8         String name = new Scanner(System.in).next();
9
10        System.out.println("Hi "+name+"!");
11    }
12 }
```

High-level language



Tech facts

SQL was invented by IBM and adopted by ANSI and ISO as the standard language for managing structured data.

Tech corner



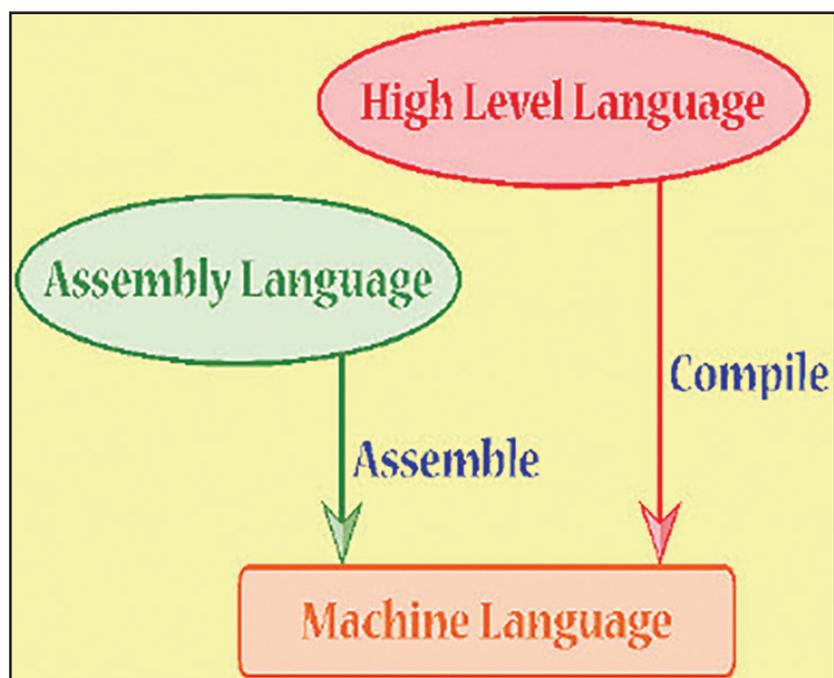
MATLAB is the acronym of **MATrix LABoratory**. It is written in C, C++ and Java. It is a numerical computing software.

Compiler and interpreter

A **compiler** is a system software translator that converts the programs written in high-level languages as a whole into machine language. This process is called **compilation**.

Example: C, C++ uses compiler

An **interpreter** is a system software translator that converts each line of high-level instruction into its equivalent machine language code. If the translation is successful, it gets executed, before the next line in the program is taken for translation. Interpreted programs are slower in execution compared to compiled programs. **Example:** BASIC



Compilation and assembly process

Fourth generation language (4GL)

Fourth generation languages (4GLs) are user-friendly and highly efficient for use. These languages typically use English-like words and phrases. Popular 4GL is Structured Query Language or SQL. Each 4GL requires its own Integrated Development Environment (IDE) for programming. MATLAB is a language used for technical and numerical computing. It is widely used in industry and academia.

Example: Fourth generation computers



```

4 d4_globals.4gl
1 DATABASE stores7
2
3 GLOBALS
4     DEFINE
5         p_customer RECORD LIKE customer.*,
6         p_orders RECORD
7             order_num LIKE orders.order_num,
8             order_date LIKE orders.order_date,
9             po_num LIKE orders.po_num,
10            ship_instruct LIKE orders.ship_instruct
11        END RECORD,
12        p_items ARRAY[10] OF RECORD
13            item_num LIKE items.item_num,
14            stock_num LIKE items.stock_num,

```

4GL example

Let us revise

- The language that is used to communicate with a computer is called a programming language.
- The set of instructions given to a computer to do a specific task is called a program. The person who writes program to computers using any programming language is called a programmer.
- Machine language is expressed in binary digits of 0s and 1s.
- Assembly language is a low-level language, which uses mnemonic codes instead of 0s and 1s.
- High-level languages use English-like statements. They are easy to learn and require less time to write.
- A compiler is a system software translator that converts the programs written in high-level languages as a whole into machine language.
- An interpreter is a system software translator that converts each line of high-level instruction into its equivalent machine language code.
- Fourth generation languages (4GLs) are user-friendly and highly efficient to use. These languages typically use English-like words and phrases.



Quick check



A. Fill in the blanks.

1. The language used to communicate with a computer is called a _____ .
2. The set of instructions given to a computer to do a specific task is called a _____ .
3. Assembly language uses _____ instead of 0s and 1s.
4. _____ and _____ languages are machine-dependent.

B. State whether the given statements are True (T) or False (F).

1. Assembly language is a low-level programming language.
2. High-level language is a machine-dependent language.
3. C++ uses interpreter to execute instructions.
4. MATLAB is an example of fourth-generation language (4GL).

Question time



A. Identify the answer based on the clues below.

1. Does not execute next line until the current line is correct.
2. This language is used instead of 0s and 1s, but still considered as a low-level language.
3. This is a language used for technical and numerical computing.
4. This language is high at speed and uses less memory.

B. Answer the following.

1. What is a computer language? List the types of computer languages.
2. What does an assembler do?
3. Highlight the differences between compiler and interpreter.

Compiler	Interpreter

4. What is a MATLAB?

Tips for teachers



Discuss the need for computer language. Explain the various types of computer languages. Write different codes in different computer languages and ask the students to identify them. Ask them to recognise which is easy to understand.

Refer more



<https://www.informationq.com/computer-language-and-its-types/>