

Categories of Computer and Computer Languages

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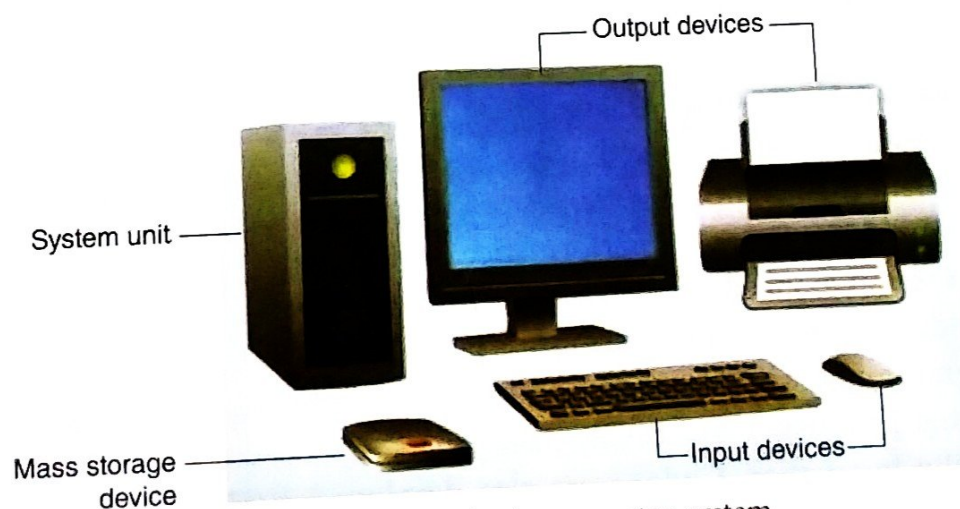
Learning Scope

Introduction, Classification of computers, Generation of computers (First Generation to Fifth Generation, Features and limitations of these generations), Analog, Digital and Hybrid computers, Special purpose and General purpose computers, Microcomputer to Supercomputer, Computer Languages(viz. Low-level and High-level language), Advantages and limitations of computer languages, Evolution of computer languages (First Generation (1GL) to Fifth Generation (5GL)), Language translators (Compiler and Interpreter)

Introduction to Computer System

We know that computer is an electronic data processing machine which accepts data (input), processes it, and then produces output. It also stores data in appropriate storage devices and retrieves it whenever necessary.

A computer system consists of two components – hardware and software. Hardware includes the physical parts of a computer such as keyboard, mouse, monitor, etc. Software is set of programs or instructions that instructs the hardware what to perform and how to perform it. Examples of software includes word processors, web browsers, games, etc.



A basic computer system

With the technological advancement, improvements and developments were made in the hardware and software components. These were consequently reflected in the performance of the computer system. These developments can be further categorised in the following ways:

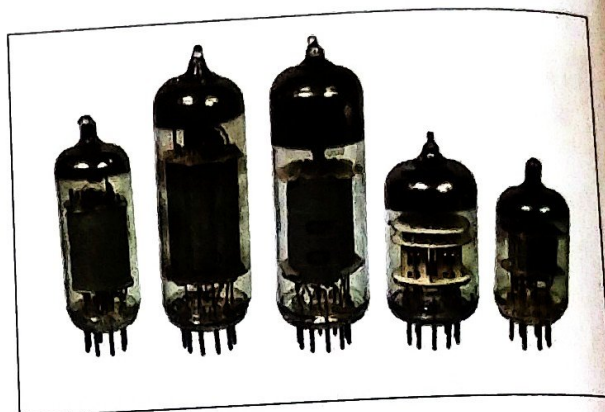
- Based on Generations
- Based on Size
- Based on Type
- Based on Purpose

I. Based on Generations

The term computer generation refers to the changes made in electronic technology. In every generation, computer technology becomes more advanced than the previous one. The major developments in computer technology that have occurred in different generations are as follows:

First Generation Computers (1940-1956)

The first generation computers used **vacuum tubes** as the main electronic component. These computers were based on machine level and assembly languages. In this generation, ENIAC (Electronic Numerical Integrator And Calculator) was developed by Professors J. Presper Eckert and John Mauchly in the USA. It was the first fully operational electronic and general-purpose computer. During this generation, a high-level programming language, FORTRAN (Formula Translation), was developed by IBM (International Business Machines).



Vacuum Tubes used in First Generation Computers

Limitations

- These computers were very large in size and occupied a lot of space.
- These computers were difficult to operate.
- They needed heavy air-conditioned systems because of the tremendous amount of heat generated by the vacuum tubes.
- These computers also consumed huge quantity of power.

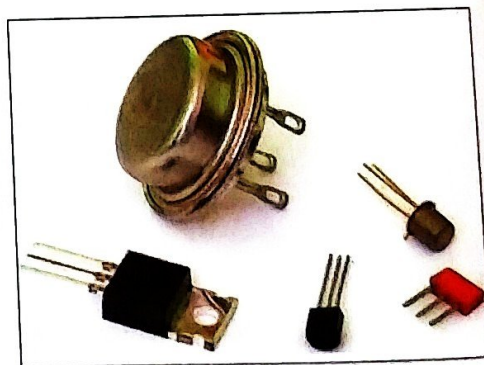
Second Generation Computers (1956-1963)

The second generation computers used **transistors** instead of vacuum tubes. With the invention of transistors, computers became smaller in size, faster in performance and more reliable. The processing speed of the computers increased from milliseconds to microseconds. During this period, some high-level programming languages like COBOL (Common Business Oriented Language) and BASIC (Beginners' All-purpose Symbolic Instruction Code) were also developed. UNIVAC (Universal Automatic Computer) and IBM1620 are examples of second generation computers.

Knowledge Corner



Prof. Howard H. Aiken of Harvard University developed the first electromechanical computer named as Harvard Mark I.



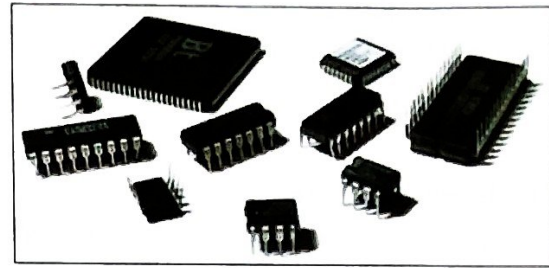
Transistors used in Second Generation Computers

Limitations

- These computers still needed a cooling system.
- They were used for specific purposes only.

Third Generation Computers (1964–1971)

The third generation computers used *integrated circuits* (ICs) that improved their performance. An integrated circuit is a compact electronic circuit containing hundreds of transistors. In ICs, the electronic components are packed on a thin piece of semi-conductor material, known as the IC chip. The use of integrated circuits further reduced the size of the computers. These computers could do fast calculations (in nanoseconds). Their capacity to hold data and information also increased due to improved secondary storage devices.



Integrated Circuits used in Third Generation Computers

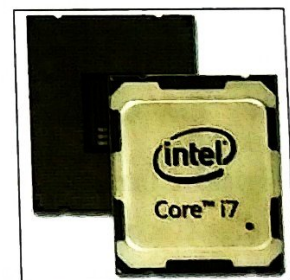
This generation of computers led to the invention of the mainframe computer. The programming languages like C, C++, Java, etc., were developed during this generation. Some examples of third generation computers are IBM 360 and Honeywell 6000 series.

Limitations

- These computers were not used for business or commercial purposes.
- The integrated circuits were difficult to maintain due to sophisticated technology.

Fourth Generation Computers (1972–2010)

Microprocessors came into existence with this generation that led to the emergence of 'microcomputers'. Presently, the 'Core i series' series is considered to be one of the most powerful microprocessors developed by the Intel Corporation, USA. The latest development of the series is the 'Core i7 11th GEN' that is being used as a processor in desktops and laptops. The storage capacity of these computers increased up to terabytes and even petabytes. All personal computers (PC) manufactured by IBM, Apple, HCL, Dell, Compaq, Lenovo, etc., belong to the fourth generation computers. Languages like DBASE III SQL (Structured Query Language), etc., were developed in this generation. Some examples of computers of the fourth generation are Apple I, STAR 1000, CRAY-X, etc.



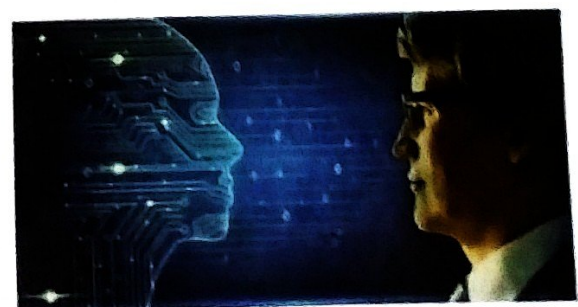
Microprocessors used in Fourth Generation Computers

Limitations

- High speed processors may need special attention during its usage.
- The manufacturing of microprocessors requires latest technology.

Fifth Generation Computers (Present and Future)

A computer does not possess intelligence. However, scientists are working to produce intelligent computers that can take decisions on their own. This concept includes providing reasoning, speech



and vision abilities to a computer. The main objective is to introduce IQ in these computers so that they can think and behave like human beings.

This concept is called 'Artificial Intelligence' (AI).

II. Based on Type

Computers can also be classified according to how they manage data. They can be classified into three main categories, namely:

- Analog Computers
- Digital Computers
- Hybrid Computers

Sub-1) Analog Computers

(An analog computer is a device that works on physical quantities such as motion, pressure, voltage, current, etc. The data input to a computer is continuous in nature. The result (output) is obtained after comparing with the standard input (values).)

For example, in a clock, the hour, minute and second hands are continuously moving and at any instance, we can know the time from the clock. When an hour hand is set at 10 and the minute hand is at 2, we read the time as 10:10 am or pm. Here, the time is obtained by comparing hour and minute hands with the marking on the dial.

The devices like meter scale, thermometer, speedometer, voltmeter, etc., are examples of analog computers.



Analog Clock

Sub-2) Digital Computers

(A digital computer is defined as an electronic device that accepts data in discrete values and produces the result in terms of digits or numbers. The internal working of a digital computer is in binary form (i.e., using only two digits 0 and 1).)

The devices like desktop, laptops, smartphones, calculators, digital watches, digital weighing machine, etc., fall under this category.

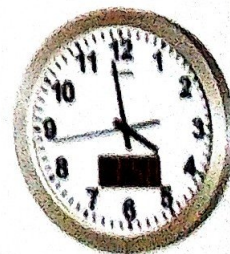


Digital weighing machine

Hybrid Computers

A hybrid computer is a combination of both digital and analog computers. The result can be obtained in analogue as well as in digital form. So, these computers are used in specialised applications where both the types of data needed to analyse the result.

For example, the clock shown alongside can be used to find time by comparing the hands with the marks on the dial as well as from the screen displaying time in numeric form. Hence, it is considered to be a hybrid computer.



Hybrid Clock

The devices such as gas pump station, cement plant, ECG (Electrocardiogram) machine, ultrasound machine, etc. are examples of hybrid computers.

III. Based on Size

Computers are also categorised on the basis of their size. The size of a computer changes in terms of processing speed and storage capacity. Higher storage capacity makes a computer capable of handling large volume of data.

On the basis of size, computers are classified as follows:

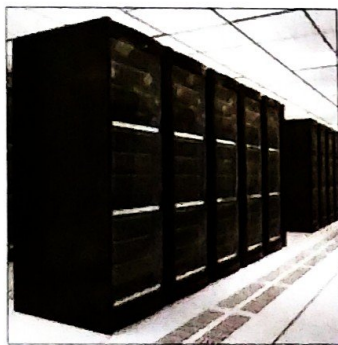
- Microcomputers
- Mainframe computers
- Minicomputers
- Supercomputers



A Microcomputer



A Minicomputer



A Mainframe Computer



A Supercomputer

Microcomputers

Microcomputers due to their compact size and multiple uses are widely used in homes, offices, shops and schools. These are used by one person at a time. They were first developed by IBM (International Business Machines) Corporation. These computers are also known as personal computers. For example, laptops, desktop computer, tablet, smartphones, Personal Digital Assistant (PDA), etc.

Minicomputers

Minicomputers are smaller than mainframe computers but bigger than microcomputers. These computers have a higher capacity to store data and also support multi-user system and Local Area Network (LAN). For example, the IBM Minicomputer and Honeywell 200

Mainframe Computers

Mainframe computers are large computers, faster with huge storage capacity. These computers are generally used in large industries, banking organisations, advanced scientific research centres etc. For example, IBM zseries, System z9 and System z10 series

Supercomputers

The most powerful computers in use today are supercomputers. These computers are used in scientific and space research, weather forecasting, robotics, etc. For example, CRAY-I developed by the CRAY Research Inc., USA was the first supercomputer developed. PARAM and ANURA are supercomputers made in India.



- PARAM is considered as India's first supercomputer.
- The Make in India supercomputer under the National Supercomputing Mission was launched in 2017.

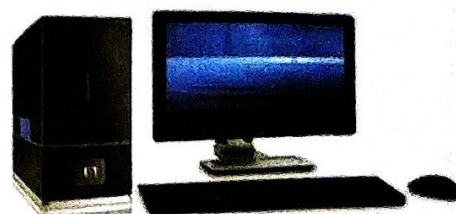
IV. Based on Purpose

Computers are also categorised according to their purpose, *i.e.* the nature of task to be processed. Thus, the classification of computers on the basis of purpose are as follows:

- General-purpose Computers
- Special-purpose Computers

General-purpose Computers

General-purpose computers are used to manage a variety of tasks. In these computers, the instructions needed to perform particular tasks are temporarily stored into the internal memory. When one job is over, instructions for another job can be loaded into the internal memory for processing automatically. Thus, the same hardware can be used to execute different programs. General-purpose computers are more versatile than special-purpose computers. They are used for various purposes like playing games, watching videos, doing research, performing calculations, preparing sales reports, etc.



General-purpose computers are used for various purposes like playing games, watching videos, etc.

Special-purpose Computers

Special-purpose computers are designed for performing a single task or a specific application. In these, a set of instructions are built into the computers for performing specific tasks. They are also known as dedicated computers because they perform a single task repeatedly. Some of the special purpose computers are explained as under:

- Mobile computers
- Game consoles
- Embedded computers

Mobile Computers

A mobile computer refers to any computer or other electronic devices that have portable functionality. They are so small in size that they can be easily carried in your pocket from one place to another. They perform calculations and can be used for creating a document similar to any other computer. They also allow us to access information from the internet and make voice or video calls. For example, smartphones, tablets, laptop, palmtop, etc.



Mobile Computers

Just to Know!

E-reader (A mobile computer)

It is an electronic device used for reading digital documents such as e-book, e-magazine, etc. The brightness of the screen is set in such a way that we don't feel any eye strain, even if we read for hours. If you are a regular reader, then it is one of your best friends to enjoy your favourite activity.



Game Consoles

Gaming consoles are electronic devices that are used to play computer games on a bigger screen. They are computers designed with special hardware and software programs. These computers are equipped with a high-speed processor and quality graphics. The user can play offline and online games and can also support multiplayer. However, you can play some fixed games on your personal computer (desktop or laptop) for the sake of entertainment. Some of the gaming consoles are PlayStation 4, Xbox Series, Nintendo Switch, etc.



Embedded Computers

Embedded computers are devices that consist of hardware and software (program) combined together for dedicated tasks. In these devices, a set of instructions are built into the computers for performing specific tasks. So, they are also known as dedicated computers. The instructions needed to perform the task are permanently stored in the internal memory of the computer. Once the command is issued, they perform the desired task.

For example, a washing machine is an embedded computer (device) to wash, rinse and dry clothes. Some more examples of embedded computers (devices) are microwave oven, refrigerator, smart television, dishwasher, etc.



Washing Machine, an example of Embedded Computer



Computer Languages

Language is a medium of communication. To communicate your views or ideas with a person, a language is essentially required.

Similarly, ^{Sub-II} computer is a machine that understands a specific form of language. Working with a computer means to establish communication between the user and the machine. In order

to execute a task, ^{we} you give instructions to the computer. These instructions must be given in the same language which the computer understands. This necessitates the need to learn computer languages.

Types of Computer Languages

Computer languages are of two types as given below:

- Low-level Language
- High-level Language

I. Low-level Language

Low-level language includes the codes that needs to be operated on the machine. They use instructions that are directly executed. Low-level languages are further classified into the following categories:

- (a) Machine language
- (b) Assembly language

(a) Machine Language

It is the fundamental language of a computer. It is written as strings of binary digits, i.e., as 0s and 1s. When the instructions are given in terms of 0s and 1s, it is known as machine language, e.g. 10010100010, 1110100101, etc. This is a machine-independent language. It means the user must be aware of the hardware architecture of a computer before writing a program in this language.



Features of Machine Language

1. It is directly understood by the system.
2. The execution doesn't require any language translator.

sub-III

1. Limitations of Machine Language

1. The process of generating binary codes is very time-consuming.
2. There is always a chance of making mistakes during the conversion into binary codes.
3. It is a machine-dependent language.

Knowledge Corner



- Computer language refers to a medium using which communication between a user and computer is established.
- FORTRAN is known as the first computer language.

Knowledge Corner



- Instruction is a command or order given to the computer to perform a specific task.
- Earlier, instructions in machine language were given by pressing switches. Switch on meant 1 (one) and switch off meant 0 (zero).

(b) Assembly Language

In an assembly language, the instructions are given to the computer in terms of mnemonics. A mnemonic is a standard short-form notation of an instruction to perform a certain task. For example,

Mnemonic: Load A (say)

It means to enter the value of variable A in the program written in assembly language.

Features of Assembly Language

1. It takes less time in coding instructions.
2. Programming logic can be developed easily.

Limitations of Assembly Language

1. A translator is required to convert the instructions into a computer-readable binary form.
2. It is a machine-dependent language.

II. High-level Language (HLL)

A high-level language is a user-friendly programming language that is independent of the computer's hardware architecture. The instructions are written almost like the English language, making it easier to develop and understand programming logic. That is why high-level languages are preferred over machine and assembly languages.

It is important to know that the programs written in high-level languages need language translators. This is because they convert them into machine language before being executed by the computer.

Some well-known high-level languages are BASIC, Pascal, C Language, C++ Language, Java Language, etc.

Sub-III

Features of High-level Languages

- They are machine independent languages.
- They are easy to learn and help to develop programming logic.
- Programs in these languages can be easily understood by the user and hence can also be modified.

Limitations of High-level Languages

- Different languages have different syntax (grammar) of writing statements.
- They require translators to convert the instructions written by the user into instructions (machine-readable binary codes) that can be understood by the computer.

Different High-level Languages

There are over 200 high-level languages that have been developed so far. However, all of them are not put into use. Languages like FORTRAN, COBOL and Pascal are almost obsolete. Some of the popular high-level languages such as BASIC, C/C++ and Java are discussed below.

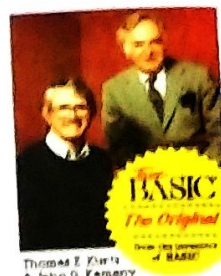
(a) BASIC

It is one of the simplest and user friendly high-level language appropriate for beginners. Generally, all types of tasks can be performed in BASIC (i.e., graphics and general programs). It is also applied in the fields of science and business. GW-BASIC and QBASIC are more popular among school students.

Knowledge Corner



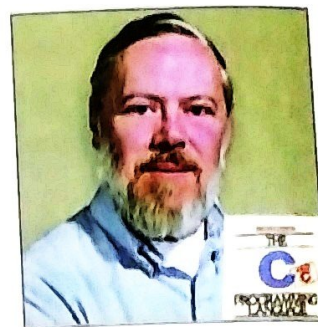
In the year 1964, BASIC was developed by Professors John G. Kemeny and Thomas E. Kurtz at the Dartmouth College in U.S.A.



Founders of BASIC,
a high-level language

(b) C Language

C Language was developed by Dennis Ritchie at the Bell Laboratories. This is a powerful language for beginners that further helps in learning other languages like C++ and Java. This language is widely used for engineering and scientific applications. It is also used in developing an operating system.



Dennis Ritchie
Inventor of C language

(c) C++ Language

This is also a general-purpose programming language derived from the C language. It is created by Danish computer programmer Bjarne Stroustrup at Bell Laboratories. It was initially known as 'C with classes' but later was renamed as C++ (C plus plus). It is easier to write programs in C++ as it allows the user to perform long operations efficiently. This is why the C++ language is more popular among software professionals.

Knowledge Corner



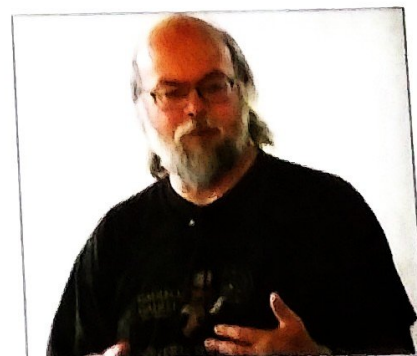
C++ language was developed in the early 1980s by Bjarne Stroustrup at AT&T (American Telephone & Telegram), Bell Laboratories, New Jersey, USA.



Bjarne Stroustrup
Inventor of C++ Language

(d) Java Language

Java is a multipurpose language that is widely used for general programming and web designing. This language is developed by Canadian programmer and software developer James A. Gosling at Sun Micro System, USA. Initially, it was named OAK (based on a tree outside the Gosling's office). It has easier syntax to write statements and develop program logic.



James Arthur Gosling:
Inventor of Java language

Differences between High-level Languages and Low-level Languages

High-level Languages	Low-level Languages
1. These languages are used to write programs in simple English and by using alphabets and numbers.	1. These languages are used to write programs with the combination of 0s and 1s.
2. They are machine-independent languages.	2. They are machine-dependent languages.

Evolution of Computer Languages

With the evolution of the computer system and technology, computer languages have also evolved. It started with the machine language then assembly language followed by the high-level language. The computer languages can also be classified under different generation. They are explained as under:

(a) First Generation Computer Language (1GL)

The first generation programming language (1GL) is better known as 'Machine Language'. The instructions were given through the switches of these computers directly to the CPU of first generation computers. The instructions were made of binary numbers, represented by 0s and 1s. Thus, it made the language easier for the understanding for the machine but difficult for the programmer.

Features of 1GLs

1. Machine language was the mode of instructions.
2. The instructions were directly stored in the memory which is then directly decoded by the CPU.

(b) Second Generation Computer Language (2GL)

The 'Assembly language' is known as second generation programming language (2GL). In this language, the instructions are given in some coded terms, known as **mnemonics** (say, ADD, LOAD, HALT, etc.) to perform certain tasks.

Since, the assembly level instructions are not directly understood by a computer (as it only understands machine language). So, it requires a language translator to convert instructions from assembly level language into machine level language, known as **Assembler**.

Features of 2GLs

1. Instructions were given by using mnemonics and codes.
2. The instructions were decoded in the CPU by using an assembler.

(c) Third Generation Computer Language (3GL)

The induction of third generation programming language (3GL) made significant enhancements to second generation language. It primarily intended to make the programming language more user-friendly. The concept of using English words to denote variables, programming structures

and commands are some of its special features. For example, FORTRAN, BASIC, Pascal, C++, Java, Python, etc.

Features of 3GLs

1. The instructions are given to a computer system by using different high-level languages.
2. The program are more user-friendly.
3. The instructions were decoded in the CPU by using language translators.

(d) Fourth Generation Computer Language (4GL)

The development of fourth generation programming language (4GL) is an attempt to reach closer to human language. The 4G languages are so simple in their use that they don't require any rigorous formal training for writing instructions.

One of the most useful 4G languages is Structured Query Language (SQL) that includes database queries, report generations, etc.

Features of 4GLs

1. It is user-friendly.
2. It is independent of any operating system.
3. The users can develop their own applications.

(e) Fifth Generation Computer Language (5GL)

The development of fifth generation computer language (5GL) made a revolutionary change in the computer's world. These languages are mainly used to make computers more sensitive and developed for fields like Artificial Intelligence. Nowadays, computers with artificial intelligence are used in the banking industry to detect fraud if anyone uses a fake credit card or debit card for a transaction.

Prolog (Programming in Logic) is an example of 5GL.

Features of 5GLs

1. These programs mainly focus on the development of artificial intelligence.
2. They also made it possible to mimic the human sense and intelligence.

Language Translators

The assembly and high-level languages are used to develop programming logic easily by the user. However, these forms of languages are not directly understood by the computer. It only understands machine language. Hence, we need a translator language processor to convert assembly and high-level languages programs into machine language programs before they can be executed by the processor. The different types of translators and their working are explained below:

1. Assembler

(Assembler is a software which is used to convert a program (a set of instructions) written in an assembly language into a machine language.) It helps a computer to perform its basic operations.)



2. Compiler

Compiler is a software that translates the complete program written in a high-level language into a machine language at once. It accepts the entire program at a time and then generates its equivalent machine code.

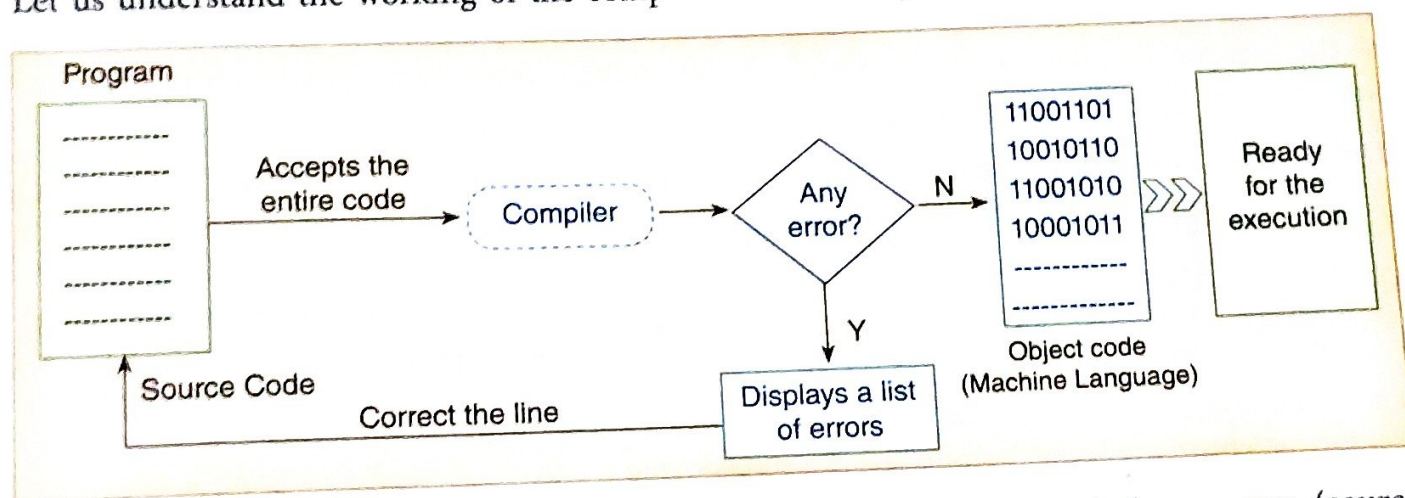
Knowledge Corner



C and C++ programming languages use a compiler.



Let us understand the working of the compiler with the help of the following illustration:



Refer to the flow diagram shown above. The compiler accepts the whole program (source code) for conversion into machine language. It then checks whether the program is error-free or not. If no, then the error messages of the whole program are displayed, and the program is redirected to the user for correction. The process continues until all the errors are corrected. Finally, it generates the machine code that can be used for the execution.

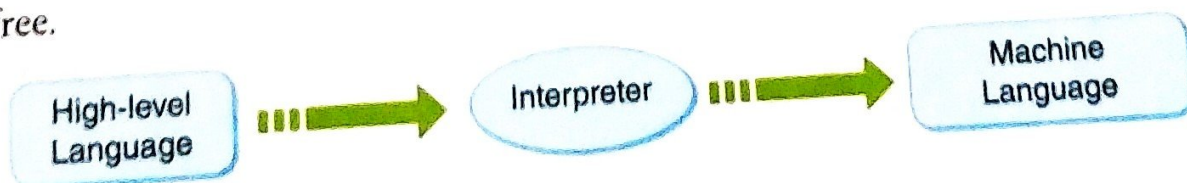
3. Interpreter

Interpreter is a software that is also used to convert a program written in a high-level language into its equivalent machine language. It accepts instructions and generates its machine codes line-by-line or statement-by-statement. At the time of execution, the control doesn't move to the next line unless the previous line/statement is error-free.

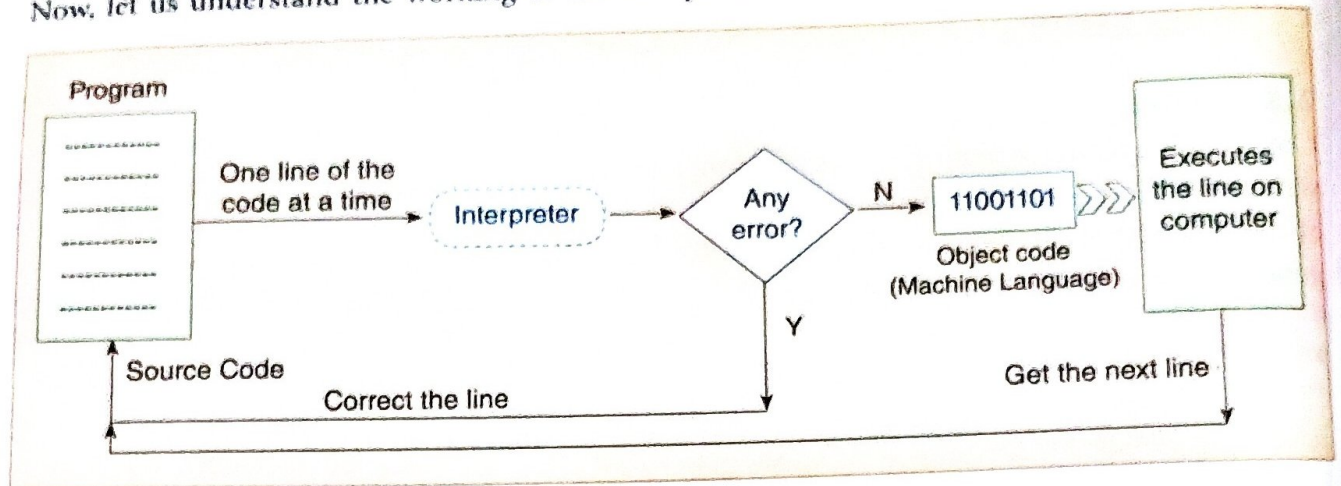
Knowledge Corner



Java language uses a compiler as well as an interpreter. BASIC and Python programming languages use an interpreter.



Now, let us understand the working of the interpreter in brief:



Refer to the flow diagram shown above. The interpreter accepts each line of the high-level program at one time. It checks whether it is error-free or not. If no, then the line is redirected to the user for the necessary correction. If the line is error-free, the machine code is generated and executes the line on the computer.

Differences between a Compiler and an Interpreter

Compiler	Interpreter
1. It converts the entire program into its machine code at once.	1. It converts the entire program into its machine code line-by-line.
2. It displays the errors for the entire program only after compilation.	2. It displays the errors of one line at a time during the conversion to its machine code.

Knowledge Corner



Every high-level language has its own specific compiler for coding it into a machine language.

Students' Notes

Chapter at a Glance

- A computer is an electronic data processing machine that accepts data(input), processes it and then produces output.
- A computer consist of two components- hardware and software.
- Hardware includes the physical components of a computer. Software is set of instructions or programs that instructs the hardware what to perform and how to perform it.
- The developments and innovation in computers can be categorised based on- Generation, Type, Size and Purpose.
- Based on Generation: There are five generations starting from first to fifth.
- Based on Type: Based on how a computer manages data, it can be classified as- analog, digital and hybrid.
- Based on Size: This classification includes- Microcomputers, Minicomputers, Mainframe computers and Supercomputers.
- Based on Purpose: On the nature of the task performed, computers are classified as- General purpose and Special-purpose computers.
- Some speical-purpose computers are- Mobile computers, Game consoles and Embedded computers.
- Computer is a machine that understands a specific form of language. There are two types of languages- Low-level language and High-level language.
- The low-level language includes the code needed to be operated on the machine. They use instructions that are directly executed. It is of two types- Machine language and Assembly language.
- The machine language is the fundamental language of a computer. it is written as string of binary digits, i.e., 0s and 1s.
- The assembly language involves giving instructions to a computer in terms of mnemonics.
- A high-level language is a user-friendly programming language that is independent of the computer's hardware architecture. The instructions are written almost like the English language, making it easier to develop and understand programming logic.
- Some high-level languages are- BASIC, C, C++ , Java, etc.
- Computer languages have also evolved over time. Starting from first generation computer language to fifth generation computer language.
- A language translator is required to convert assembly language and high-level language to machine language. They are- Assembler, Compiler and Interpreter.
- An assembler converts program written in assembly language to machine language.
- A complier is a software that translates the complete program written in high-level language into a machine language at once.
- An interpreter accepts instructions and generates its machine code line-by-line.

EXERCISES

Objective

I. Choose the correct option:

1. A converts a complete program written in a high-level language into a machine language at once.
 (a) converter ☒ (b) compiler (c) interpreter (d) assembler
2. A program written in a high-level language is called
 (a) object code (b) code ☒ (c) source code (d) binary code
3. Which of the following is not a high-level language?
☒ (a) Assembly language (b) Java
 (c) BASIC (d) Python
4. Which of the following is known as first generation programming language?
 (a) High-level language (b) Assembly language
☒ (c) Machine language (d) none of these
5. An electrocardiogram (ECG) is an example of computer.
 (a) digital (b) analog ☒ (c) hybrid (d) all of these
6. Who developed the BASIC programming language?
☒ (a) John G. Kemeny and Thomas E. Kurtz (b) Dennis Ritchie
 (c) Bjarne Stroustrup (d) James A. Gosling
7. Which of the following is not a programming language?
 (a) C++ (b) COBOL (c) FORTRAN ☒ (d) English
8. Which of the following is known as India's first supercomputer?
 (a) SUPREME (b) SIERRA (c) FUGAKU ☒ (d) PARAM

II. Fill in the blanks:

1. ENIAC was a fully electronic and general purpose first generation computer.
2. Transistors replaced vacuum tubes in the second generation computers.
3. Machine language is used to give instructions in terms of 0 and 1.
4. The fifth generation computer languages developed the concept of Artificial Intelligence.
5. An assembler is a software which is also known as language translator.
6. The Java language uses both compiler and interpreter.
7. Machine lang. is known as the first computer language.
8. Meter Scale is a type of Analog computer.

III. Write the full forms of the following:

1. ENIAC : Electronic Numerical Integrator And Calculator
- ✓ 2. IBM : International Business Machine
3. FORTRAN : Formula Translation
4. SQL : Structured Query Language
5. BASIC : Beginners' All purpose Symbolic Instruction code
- ✓ 6. UNIVAC : Universal Automatic Computer
7. PROLOG : Programming in Logic
8. COBOL : Common Business Oriented Language

IV. Name the high-level languages for the given areas of applications:

1. A language translator
Compilers, Interpreters or Assemblers
2. A high-level language used for engineering and scientific applications
Fortran / C / C++ etc.
3. A high-level language used for web designing
Java Script
4. A game console
C++
5. A fifth generation computer language
Prolog / Artificial Intelligence (AI)

V. Match the following:

- | | |
|----------------------------|-----------------------------|
| ✓ 1. Machine Language (c) | (a) Translator (3) |
| 2. Mnemonics (e) | (b) C++ (4) |
| ✓ 3. Interpreter (a) | (c) Binary Digits (1) |
| ✓ 4. Bjarne Stroustrup (b) | (d) High-level Language (5) |
| 5. BASIC (d) | (e) Assembly Language (2) |

VI. Name the main component/technique used in:

1. First Generation Computers: Vacuum tube
2. Second Generation Computers: Transistors
3. Third Generation Computers: Integrated Circuits (ICs)
4. Fourth Generation Computers: Microprocessors
5. Fifth Generation Computers: Artificial Intelligence (AI)

VII. Assertion and Reason based questions:

1. Solved

Assertion (A): Language translators are used to convert programs written in high level language to machine readable language programs.

Reason (R): Compilers convert a program written in a high-level language into a machine language.

Based on the above discussion, choose an appropriate statement from the options given below:

- (a) Both A and R are true and R is the correct explanation of A.
- (b) Both A and R are true and R is not the correct explanation of A.
- (c) A is true but R is false.
- (d) A is false but R is true.
- (e) Both A and R are false.

Ans. (a) Both A and R are true and R is the correct explanation for A.

2. Unsolved

Assertion (A): Machine language is directly understood by the system. The execution does not require any language translator.

Reason (R): Machine language is a high level language consisting of English words, hence it is easily understood by the computer.

Based on the above discussion, choose an appropriate statement from the options given below:

- (a) Both A and R are true and R is the correct explanation of A.
- (b) Both A and R are true and R is not the correct explanation of A.
- ☒ (c) A is true but R is false.
- (d) A is false but R is true.
- (e) Both A and R are false.

VIII. Case Study based questions:

Solved

1. A computer generation refers to the period when there is a change in technology. During different generations, several devices and languages were developed. From the options in the below given box, identify the developments made according to their generations.

UNIVAC	FORTRAN	Microprocessor	Mainframe
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Name the development (selecting from the above box) made in:

- (a) First generation of computers
- (b) Second generation of computers
- (c) Third generation of computers
- (d) Fourth generation of computers
- (b) UNIVAC
- (d) Microprocessor

Ans. (a) FORTRAN
(c) Mainframe

2. With the evolution of computer and technology, computer languages have also been evolved. It started with the machine language, then the assembly language followed by the high-level language. The computer languages are also classified into different generations viz. 1GL to 5GL.

Based on the above case, answer the following questions:

- (a) In which form the instructions were given in 1GL?
 (i) Octal numbers (ii) Hexa-Decimal numbers
 (iii) Binary numbers (iv) Base 4 numbers
- (b) In which generation of languages, assembly level language was used?
 (i) 1GL (ii) 2GL (iii) 3GL (iv) 4GL
- (c) Which of the following generation of languages led to the development of Artificial Intelligence (AI)?
 (i) 1GL (ii) 3GL (iii) 4GL (iv) 5GL
- (d) Which of the following high-level languages was developed in 4GLs?
 (i) SQL (ii) FORTRAN (iii) C++ (iv) JAVA
- Ans. (a) (iii) Binary numbers (b) (ii) 2GL
 (c) (iv) 5GL (d) (i) SQL

Unsolved

1. The computer languages are categorised into low-level and high-level languages. Low-level language is further classified into two types viz. machine language and assembly language. A computer understands instructions in machine language (using digits 0's and 1's). Hence, a computer program needs to be converted into machine language using any translator, e.g., compiler, interpreter or assembler. However, the instructions given in high-level languages are easily understood by the users.

Based on the above case, answer the following questions:

- (a) Which language uses binary code?
 (i) High-level language (ii) Assembly language
 (ii) Machine language ☒ (iv) Machine and assembly languages
- (b) The instructions are written using English letters or words in
☒ (i) High-level language (ii) Machine language
 (iii) Low-level language (iv) Assembly language
- (c) Which source code is converted into machine code using Assembler?
 (i) High-level ☒ (ii) Assembly language
 (iii) Machine language (iv) Binary level
- (d) Which of the following is not used as a translator?
 (i) Compiler (ii) Assembler ☒ (iii) Converter (iv) Interpreter
2. An analog computer works on physical quantities such as length, mass, time, current, voltage, etc.; whereas a digital computer works on digits or discrete values. A hybrid computer is a combination of analog as well as digital computers.
- With reference to the above discussion, answer the following questions:
- (a) Name an analog computer. - *A speedometer is an example of an analog.*
- (b) What type of computer is a Smartphone? *is a digital computer*
- (c) Name a hybrid computer. *is an ECG machine*
- (d) What type of computer is a Smart TV? *is a digital computer.*

Subjective

I. Define the following:

1. Analog Computers (Page-4)

V-1 ✓ 2. An Assembler (Page-12)

3. Second Generation Computer Languages

also known as assembly language, is a low level programming language that uses symbolic codes or mnemonics to represent machine level instructions.

4. Digital Computers (Page-4)

5. Fourth Generation Computer Languages

is a type of high-level programming language designed to be closer to human language and easier to use than previous generations.

6. Embedded Computers

also known as embedded systems, is a specialized computer system designed to perform a specific, dedicated function within a larger device or system.

II. Differentiate between the following:

1. Machine Language and Assembly Language

V-1 ✓ 2. High-level and Low-level Languages Page-11

V-1 ✓ 3. Compiler and Interpreter Page-14

4. First and Third Generation Computer Languages

III. Long Answer Questions:

V-1 ✓ 1. What are the limitations of machine language? (P-8)

2. Mention two features of Fifth Generation Computer languages. (P-12)

V-1

- ✓ 3. What are the features of a high-level language? (p-9.)
4. Why do we need to learn computer languages? (p-7)
5. In what ways instructions were given in IGL? (p-11)

Activities

Quiz Time

Make teams of two students each and answer the following questions in one word:

1. A language where instructions are written in binary digits
2. The form that mnemonics need to be coded into
3. A software used to convert instructions from an assembly level language to a machine level language
4. A language where instructions are written like English
5. Founder of the Java language
6. Language used to update the Windows operating system
7. Inventor of the C language
8. A language processor used to convert high level language instructions to machine language form line-by-line



Group Discussion

Make groups comprising five-six students each and discuss about the following topics:

- (a) Development of high-level languages
- (b) Significance of translators

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