CSC 432 Principles of Programming Languages II

A programming language is a **computer language** that is used by **programmers (developers) to communicate with computers**. It is a set of instructions written in any specific language (C, C++, Java, Python) to perform a specific task.

A programming language is mainly used to **develop desktop applications, websites, and mobile applications**.

Types of programming language

1. Low-level programming language

Low-level language is **machine-dependent (0s and 1s)** programming language. The processor runs low- level programs directly without the need of a compiler or interpreter, so the programs written in low-level language can be run very fast.

Low-level language is further divided into two parts -

i. Machine Language

Machine language is a type of low-level programming language. It is also called as **machine code or object code**. Machine language is easier to read because it is normally displayed in binary or hexadecimal form (base 16) form. It does not require a translator to convert the programs because computers directly understand the machine language programs.

The advantage of machine language is that it helps the programmer to execute the programs faster than the high-level programming language.

ii. Assembly Language

Assembly language (ASM) is also a type of low-level programming language that is designed for specific processors. It represents the set of instructions in a **symbolic and human-understandable form**. It uses an assembler to convert the assembly language to machine language.

The advantage of assembly language is that it requires less memory and less execution time to execute a program.

2. High-level programming language

High-level programming language (HLL) is designed for **developing user-friendly software programs and websites**. This programming language requires a compiler or interpreter to translate the program into machine language (execute the program).

The main advantage of a high-level language is that it is **easy to read, write, and maintain**.

High-level programming language includes **Python, Java, JavaScript, PHP, C#, C++, Objective C, Cobol, Perl, Pascal, LISP, FORTRAN, and Swift programming language**.

A high-level language is further divided into three parts -

i. Procedural Oriented programming language

Procedural Oriented Programming (POP) language is derived from structured programming and based upon the procedure call concept. It divides a program into small procedures called **routines or functions**.

Procedural Oriented programming language is used by a software programmer to create a program that can be accomplished by using a programming editor like IDE, Adobe Dreamweaver, or Microsoft Visual Studio.

The advantage of POP language is that it helps programmers to easily track the program flow and code can be reused in different parts of the program.

Example: C, FORTRAN, Basic, Pascal, etc.

ii. Object-Oriented Programming language

Object-Oriented Programming (OOP) language is **based upon the objects**. In this **programming language, programs are divided into small parts called objects**. It is used to implement real-world entities like inheritance, polymorphism, abstraction,etc in the program to makes the program resusable, efficient, and easy-to-use.

The main advantage of object-oriented programming is that OOP is faster and easier to execute, maintain, modify, as well as debug.

Example: C++, Java, Python, C#, etc.

iii. Natural language

Natural language is a **part of human languages** such as English, Russian, German, and Japanese. It is used by machines to understand, manipulate, and interpret human's language. It is used by developers to **perform tasks such as translation, automatic summarization, Named Entity Recognition (NER), relationship extraction, and topic segmentation**.

The main advantage of natural language is that it helps users to ask questions in any subject and directly respond within seconds.

3. Middle-level programming language

Middle-level programming language **lies between the low-level programming language and high-level programming language**. It is also known as the intermediate programming language and pseudo-language.

A middle-level programming language's advantages are that it supports the features of high-level programming, it is a user-friendly language, and closely related to machine language and human language.

Example: C, C++, language

Computer programming languages are used to communicate instructions to a computer. They are based on certain syntactic and semantic rules, which define the meaning of each of the programming language constructs.

Today I've got a list of every programming language I could find. I divided them into the following categories:

- Interpreted Programming Languages
- Functional Programming Languages
- Compiled Programming Languages
- Procedural Programming Languages
- Scripting Programming Languages
- Markup Programming Languages
- Logic-Based Programming Languages
- Concurrent Programming Languages
- Object-Oriented Programming Languages

INTERPRETED PROGRAMMING LANGUAGES

*An **interpreted language** is a programming language for which most of its implementations execute instructions directly, without previously compiling a program into machine-language instructions. The interpreter executes the program directly, translating each statement into a sequence of one or more subroutines already compiled into machine code.*

APL

Named after the book *A Programming Language* (Iverson, Kenneth E., 1962), APL is an array programming language. It can work simultaneously on multiple arrays of data. It is interpretive, interactive and a functional programming language.

AutoIt

It is a freeware automation language for Microsoft Windows. It's main intent is to create automation scripts that can be used for the execution of certain repetitive tasks on Windows.

BASIC

Developed by John George Kemeny and Thomas Eugene Kurtz at Dartmouth in 1964, it is an acronym for **B**eginner's **A**ll-purpose **S**ymbolic **I**nstruction **C**ode. It was designed with the intent of giving the non-science people an access to computers.

Eiffel

It is an object-oriented programming language that is ISO-standardized and used to develop extensible and reusable software. It is a development platform for many industries such as finance, aerospace and video gaming.

Forth

It is a structured imperative programming language, which bases its implementation on stacks. It supports an interactive execution of commands as well as the compilation of sequences of commands.

Frink

Developed by Alan Eliasen and named after Professor John Frink, a popular fictional character. It is based on the Java Virtual Machine and focuses on science and engineering. Its striking feature is that it tracks the units of measure through all the calculations that enables quantities to contain their units of measurement.

Game Maker Language

It is an interpreted computer programming language intended to be used in cooperation with Game Maker, an application for game creation. Mark Overmars, a Dutch computer scientist, designed this language.

ICI

Designed by Tim Long in 1992, ICI is a general purpose interpreted computer programming language. It supports dynamic typing, flexible data types and other language constructs similar to C.

J

Ken Iverson and Roger Hui developed this programming language that requires only the basic ASCII character set. It is an array programming language that works well with mathematical and statistical operations.

Lisp

Lisp is the second-oldest high-level programming language in widespread use today. The name Lisp is derived from 'List Processing Language'. One of the important data structures that Lisp supports is linked list. Lisp programs deal with source code as a data structure.

Lua

Members of the Computer Graphics Technology Group developed Lua in 1993. It is an imperative and procedural programming language that was designed as a scripting language. It is known for being simple yet powerful.

M

M is short for MUMPS, a programming language created for the health care industry. Neil Pappalardo, the founder of medical information technology and his associates developed the M language.

Pascal

It is a procedural programming language that was intended to use data structuring and structured programming. Niklaus Wirth, a Swiss computer scientist designed this language and it was named after Blaise Pascal, a French mathematician and philosopher.

PCASTL

An acronym for *by Parent and Childset Accessible Syntax Tree Language*, it is a high-level language developed by Philippe Choquette and falls under the class of interpreted computer programming languages. It is specially designed for self-modifying code.

Perl

Perl is a high-level interpreted programming language that supports dynamic programming. It was developed by Larry Wall, a linguist who served as a systems administrator at NASA. It provides the programmers with text processing facilities and has a blend of features adopted from various languages like C, Lisp, and Awk.

PostScript

It is used in the desktop publishing field and is known as a page description language. It is a dynamically typed stack-based programming language developed by John Warnock, an American computer scientist and Charles Geschke, a notable figure in the field of computer science. These developers went on to found the very well-known company, Adobe Systems.

Python

It is a high-level programming language that supports imperative, object-oriented, and functional programming paradigms. In its features like the dynamic type system and automatic memory management, it is similar to Perl. Originally released in 1991 by Guido van Rossum, a Dutch computer programmer, Python is an open community-based language whose development is managed by the Python Software Foundation.

REXX

Short for Restructured Extended Executor, REXX is an interpreted language developed by IBM. It was designed with an intent to be an easily learnable and readable language. NetRexx is the IBM's implementation of REXX that offers object-oriented programming. Object REXX is an object-oriented scripting language that is based on REXX.

Ruby

The efforts for developing this language initiated in Japan in the 1990s. Similar to Perl, it has a dynamic type system and an automatic memory management. It supports multiple programming paradigms and is a dynamic object-oriented language.

S-Lang

Originally developed as a stack-based language, S-Lang has evolved as a language similar to C. It was developed by John E. Davis.

Spin

It is a multitasking object-oriented programming language whose compiler converts the Spin code into bytecodes. Multiple Spin code threads can run at a time, thus enabling multitasking. Spin was developed by Chip Gracey of Parallax.

FUNCTIONAL PROGRAMMING LANGUAGES

Functional programming languages *define every computation as a mathematical evaluation. They focus on the application of functions. Many of the functional programming languages are bound to mathematical calculations.*

Charity

It is a purely functional, not-Turing-complete language, which means that all its programs are guaranteed to terminate. Charity was designed at the University of Calgary, a public University in Canada.

Clean

It is a purely functional programming language that supports portability across platforms, automatic garbage collection, multiple data structures and referential transparency, which means that a function with a given input will always give the same output.

Curry

It is a functional logic programming language that implements functional and logic programming as well as constraint programming, wherein the relationships between variables are stated in the form of constraints.

Erlang

It is a concurrent programming language that includes a sequential subset, which supports functional programming. Ericsson developed Erlang as a distributed soft real-time and fault-tolerant language and released it as an open source computer programming language in 1998. It is one of the most popularly used functional programming languages.

F#

It targets the .NET Framework and supports both functional as well as imperative object-oriented programming. Don Syme at the Microsoft Research developed this language, which is now being developed at the Microsoft Developer Division. F Sharp, as it is called, will soon be integrated into the .NET Framework and Visual Studio.

Haskell

Named in honor of Haskell Curry, a logician, Haskell is a standardized purely functional language. It supports pattern matching, definable operators, single assignment, algebraic data types and recursive functions.

Joy

It is a purely functional language that is based on a composition of functions. Manfred von Thun of La Trobe University in Australia developed this language.

Kite

It came up in 2006 with a feature set consisting of a blend of object-oriented and functional programming features. It is a fast-running language. Interestingly, Kite uses the pipe character for functional calls rather than using the period or arrow characters in other languages.

ML

Robin Milner and his associates at the University of Edinburgh came up with ML in the 1970s. It is an impure functional language as it supports imperative programming. Standard ML is popular among compiler writers and is a modular, functional programming language. Alice is a dialect of Standard ML, which supports distributed computing, multithreading and constraint programming. Caml is another dialect of ML and is a statically typed language that supports automatic memory management. Ocaml is the implementation of Caml that is developed as an open source project. JoCaml is a version of Ocaml based on join-calculus.

Nemerle

It is a statically typed programming language that is designed for the .NET platform. Programs in Nemerle are compiled into an intermediate language bytecode. It supports functional, imperative, and object-oriented programming.

OPAL

The name stands for Optimized Applicative Language and is a functional programming language developed at the Technical University of Berlin.

OPS5

It is a rule-based production system computer language that became the first language to be used in an expert system.

Q

It is called Q for being an equational programming language. It is an interpreted functional language that was designed by Albert Graf at the University of Mainz in Germany. It can be described as a set of equations used to evaluate expressions.

COMPILED PROGRAMMING LANGUAGES

*A **compiled language** is a programming language whose implementations are typically compilers (translators that generate machine code from source code), and not interpreters (step-by-step executors of source code, where no pre-runtime translation takes place). (Wikipedia)*

Ada

It is a statically typed, structured, imperative programming language that is based on Pascal. A team of CII Honeywell Bull that was led by Jean Ichbiah developed Ada. The Ada compilers are validated for mission-critical systems. Ada is an internationally standardized computer programming language.

ALGOL

Algorithmic Language, as it is called, is actually a family of imperative programming languages that was developed in the middle 1950s. It proved instrumental in the creation of programming languages like BCPL, B and C. Ole-Johan Dahl and Kristen Nygaard of the Norwegian Computing Center in Oslo were the brains behind Simula.

C

Dennis Ritchie at the Bell Telephone Laboratories developed C to be used on the Unix platform. It is a general-purpose, cross-platform, procedural, imperative programming language. It is used for implementing system software and application software and is one of the most-used computer programming languages of today. The development of C++ and C# was influenced by C.

C++

It consists of a combination of high-level and low-level language features and is hence considered as a middle-level programming language. BjarneStroustrup of Bell Labs developed C++ as an extension of the C language. Originally known as ‘C with Classes’, it came to be known as C++ from 1983. It is a multi-paradigm language that supports procedural programming, generic programming, object-oriented programming, and data abstraction.

C#

C Sharp is a multi-paradigm programming language that supports imperative, generic and object-oriented programming. It is a part of the Microsoft .NET Framework. It is similar to C++ in its object-oriented syntax and is also influenced by Java and Delphi.

CLEO

It is known as the Clear Language for Expressing Orders and is a computer language for the LEO computer.

COBOL

The name stands for Common Business-Oriented Language that is designed for the business and finance domain. COBOL 2002 standard supports object-oriented programming. It is one of the very old programming languages that are still in use.

Cobra

It is an object-oriented programming language that runs on .NET and Mono frameworks. Chuck Esterbrook developed it. Its design is influenced by languages like Python and C#. It supports static and dynamic typing and is suited for unit tests. Today, it is an open source project.

D

Originally designed as an enhancement of C++, it is also influenced by Java, Eiffel, and C#. It is an object-oriented, imperative, multi-paradigm system programming language developed by Walter Bright of Digital Mars.

DASL

Acronym of Distributed Application Specification Language, it is a high-level, strongly typed programming language that was developed at the Sun Microsystems. It was created with an intent to be used for developing web applications.

DIBOL

Acronym of Digital Interactive Business Oriented Language, DIBOL is a general-purpose procedural imperative programming language. It is fairly similar to COBOL as it's best suited for the development of Management Information Systems.

Fortran

It is a procedural, imperative, general purpose computer programming language that works well for scientific computations and numeric operations. After IBM developed it in the 1950s, it soon gained popularity in programming. It is very popular in the field of high-performance computing. It is a structured and compiled programming language that is a subset of Fortran95. Fortran 2003, a revised version of Fortran supports object-oriented programming.

Java

It is a general-purpose computer programming language that is concurrent, class-based, object-oriented, and specifically designed to have as few implementation dependencies as possible. Compiled Java code can run on all platforms that support Java without the need for recompilation. It is a very popular language of the modern times.

JOVIAL

It is a high-order computer programming language similar to ALGOL. It is best-suited to the design and development of embedded systems.

Objective-C

It is a reflective object-oriented programming language that adds messaging services to C.

SMALL

The name stands for Small Machine Algol-like Language. It provides the programmers with abilities to write an ALGOL-like code that can be run on small machines.

Smalltalk

It is a reflective, object-oriented programming language that supports dynamic typing. Alan Kay, Adele Goldberg, Dan Ingalls, Scott Wallace, Ted Kaehler and their associates at Xerox PARC developed Smalltalk. They designed it for educational use and it soon became popular. VisualWorks is a prominent implementation of Smalltalk. Squeak is a programming language that is in the form of an implementation of Smalltalk. Scratch is a visual programming language based on Squeak.

Turing

It was developed by Ric Holt and James Cordy of the University of Toronto, Canada, in 1982. It was named in honor of the British computer scientist, Alan Turing. This Pascal-like language is a freeware since 2007.

Visual Basic

It is an event-driven programming language that is packaged with an integrated development environment. It inherits many of its features from BASIC. Its graphical development features make it easy for beginners to learn VB.

Visual FoxPro

It is an object-oriented and procedural programming language derived from FoxPro. It is integrated with a relational database system of its own and does not require an additional programming environment. It supports dynamic programming.

XL

It is created with an intent to support concept programming, a programming paradigm that focuses on how concepts residing in a programmer's mind can be transformed into code constructs. Programmers can reconfigure XL's syntax and semantics.

PROCEDURAL PROGRAMMING LANGUAGES

Procedural (imperative) programming *implies specifying the steps that the programs should take to reach to an intended state. A procedure is a group of statements that can be referenced through*

a procedure call. Procedures help in the reuse of code. Procedural programming makes the programs structured and easily traceable for program flow.

Bliss

It is a system programming language and was one of the best-known languages of this type till C came up. W.A. Wolf, D.B. Russell and A.N. Habermann of the Carnegie Mellon University developed Bliss. It includes exception handling mechanisms, coroutines and macros while it excludes the goto statement.

ChucK

It is a concurrent and strongly timed audio programming language that runs on Mac OS X, Linux as well as Microsoft Windows. It is especially known for the ability it gives to the programmers to do some modifications even in the running programs.

CLIST

It is a procedural programming language in the form of a set of commands that need to be executed in a sequence like that of a batch file.

HyperTalk

It is a high-level programming language that was intended to be used by programmers at the beginner's level. The programmers of this computer language were known as authors and the act of writing programs was called scripting. HyperTalk was designed by Dan Winker in 1987. Structurally, it resembles Pascal.

Modula-2

It is a general-purpose procedural language created in 1978 by Niklaus Wirth at ETH. It is similar to Pascal and has systems programming and multiprogramming features.

Oberon

Niklaus Wirth, the man behind Pascal and Modula came up with Oberon in 1986. It was designed as a part of the Oberon operating system. It is similar to Modula-2 but smaller than it.

Component Pascal

It is a programming language that seems to be related to Pascal, but is actually incompatible with it. It is actually a variant of Oberon-2. Lagoona is an experimental programming language that supports component-oriented programming, a paradigm of decomposing a system into logical or functional components. Michael Franz, a student of Niklaus Wirth developed Lagoona. Seneca, better known as Oberon-2 is an extension of the Oberon programming language.

MATLAB

It is a numerical computing environment and a programming language that enables matrix computations, function plotting, and algorithm implementation. It can also be used for user interface creation. MathWorks created MATLAB.

Occam

It is an imperative procedural language that was developed by David May and his colleagues at INMOS. It is similar to Pascal. Occam-pi is a variant of Occam that has been extended to include nested protocols, recursion, protocol inheritance, array constructors and run-time process creation.

PL/C

It was developed for being used to teach programming. It was created at the Cornell University in the 1970s.

PL/I

It is an imperative computer programming language targeted at scientific and engineering applications. Mainly intended to perform data processing, it also supports structured programming and recursion.

Rapira

It is a procedural programming language that was used in teaching computer programming in Soviet schools. Developed in the USSR, initially this language had Russian-based keywords. English keywords were incorporated later.

RPG

This programming language is used for business applications. It is available with the IBM's System I midrange computers.

SCRIPTING LANGUAGES

Scripting languages *are programming languages that control an application. Scripts can execute independent of any other application. They are mostly embedded in the application that they control and are used to automate frequently executed tasks like communicating with external programs.*

AppleScript

It is a scripting language that is built into the Mac OS.

Awk

Awk was born in the Bell Labs in the 1970s. It is used for processing text-based data in data streams and files and uses the string datatype, arrays, and regular expressions.

BeanShell

It is a java scripting language that is syntactically similar to Java and runs on the Java Runtime Environment along with scripting commands and syntax.

ColdFusion

It is an application server and software development framework that comes with an associated scripting language known as ColdFusion Markup Language. It is known as CFML and is similar to HTML in terms of its syntax.

F-Script

It is an object-oriented scripting language that is closely similar to Smalltalk with an additional feature of array programming.

JASS

It is an event-driven scripting language that provides the programmers with an extensive API.

Maya Embedded Language

Abbreviated as MEL, it is a scripting language that is used to support tasks on the Maya software. Its syntax resembles that of Perl.

Mondrian

This scripting language is aimed for Internet use and is looked upon as being a combination of Haskell and Java.

PHP

PHP is one of the very popularly used general purpose scripting languages. It is developed for creating dynamic web pages and supports a command line interface capability.

Revolution

It is a rapid application development language that is based on HyperTalk. It is a cross-platform language that supports dynamic typing.

Tcl

It is a scripting language, which is believed to be easy to learn. It is used for rapid prototyping and has found utility in embedded systems.

VBScript

It is an active scripting language that Microsoft developed as a variation of Microsoft Visual Basic. VBScript is a default component with each of the Desktop releases of Microsoft Windows.

Windows PowerShell

It is Microsoft's command line shell and a scripting language. Released in 2006, it is available with Windows XP, Windows Vista as also with Windows Server 3003 and Windows Server 2008. It works in collaboration with Microsoft .NET Framework by means of executables, forms

of standalone applications, regular .NET classes, cmdlets that are specialized .NET classes and scripts, the compositions of cmdlets and imperative logic.

MARKUP LANGUAGES

*A **markup language** is an artificial language that uses annotations to text that define how the text is to be displayed.*

Curl

It is a reflective object-oriented programming language. It is a markup language similar to HTML. Curl is an object-oriented programming language supporting multiple inheritance.

SGML

Standardized General Markup Language (SGML) has descended from IBM's Generalized Markup Language. It is an ISO standard metalanguage that can define markup languages for documents. It was designed with the intent of sharing machine-readable documents of large projects that had to be retained for long years.

HTML

Hypertext Markup Language, abbreviated as HTML, is the most prominent markup language that is used for web pages. It is written in the form of HTML tags that are surrounded by angular brackets. HTML tags describe the appearance of the text in a document and can be embedded into certain other code to affect the web browser behavior. HTML uses the SGML default syntax.

XML

The name stands for Extensible Markup Language. It is extensible because it allows the users to define their own XML elements. It supports the sharing of structured data over the Internet and the encoding and serializing of data. It originated as a subset of SGML. XPath is the XML Path Language that is used to select nodes from an XML document. It supports the computation of values. XQuery is used to query the collections of XML data. Extensible Stylesheet Language Transformations (XSLT) is an XML-based language that is used for the transformation of XML

documents into human-readable formats. Apache Ant is a tool for the automation of software build processes. It uses XML to describe the build processes.

XHTML

It is a markup language that is similar to HTML and follows the XML syntax. It is midway between HTML and XML. XHTML documents allow automated processing of data.

LOGIC-BASED PROGRAMMING LANGUAGES

Logic programming *is a type of programming paradigm which is largely based on formal logic. Any program written in a logic programming language is a set of sentences in logical form, expressing facts and rules about some problem domain. (Wikipedia)*

ALF

Algebraic Logic Functional Programming Language is a multi-paradigm programming language that is a combination of functional programming and logic programming. ALF program statements are compiled into instructions of an abstract machine. An emulator written in C executes the programs of the abstract machine.

Fril

Fril language was designed by Trevor Martin and Jim Baldwin at the University of Bristol in the 1980s. It is for first-order predicate calculus. It supports fuzzy sets and metaprogramming and is based on the Prolog syntax.

Janus

Janus supports concurrent and constraint programming.

Leda

This computer programming language is a blend of logic-based, functional, imperative and object-oriented programming. It is thus one of the multi-paradigm languages.

Oz

It is a multi-paradigm language that supports functional, logic-based, imperative and object-oriented programming. Oz also supports concurrent and distributed programming. Constraint programming that is supported by Oz is one of the strengths of this language.

Poplog

It is a powerful multi-paradigm software development environment whose core language is POP-11. All the languages of this development environment share a common language editor and are incrementally compiled programming languages.

Prolog

It is a general-purpose programming language that supports logic programming and is often linked with artificial intelligence and computational linguistics. The language is declarative and the program logic is expressed in the form of relations. Mercury is a functional logic programming language that is based on Prolog. Strawberry Prolog is a dialect of Prolog, which is supposed to be easy to use. Visual Prolog is a strongly typed extension of Prolog that supports object-oriented programming. It is a compiled logic-based programming language.

ROOP

It is a multi-paradigm language that is built on C++. It is intended to be used with artificial intelligence systems. Its features offer a blend of procedural, logic-based, and object-oriented programming.

CONCURRENT PROGRAMMING LANGUAGES

Concurrent programming *is a computer programming technique that provides for the execution of operations concurrently — either within a single computer, or across a number of systems. In the latter case, the term distributed computing is used. (Wikipedia)*

ABCL

It is actually a family of Actor-Based Concurrent Languages, which was developed in Japan during the 1980s and the 1990s. ABCL/1, ABCL/R, and ABCL/R2 are some members of the ABCL family.

Afnix

It is a multi-threaded functional programming language. Its interpreter is written in C++. Its runtime engine supports both 32 and 64 bit platforms.

Cilk

Created at the MIT Laboratory in 1994, Cilk supports multithreaded parallel programming.

Concurrent Pascal

Per Brinch Hansen, a Danish-American computer scientist created Concurrent Pascal for writing operating systems and programming real-time systems.

E

It is an object-oriented programming language that supports distributed programming. Mark Miller, Dan Bornstein and associates at the Electric Communities developed E in 1997. Its syntax resembles that of Java.

Joule

Joule is a concurrent dataflow programming language that preceded the E programming language. It is used for distributed applications.

Limbo

Developed at the Bell Labs, Limbo is used for programming distributed systems. Its striking feature is its compiler's ability to generate architecture-independent object code. Limbo is used for applications running on Inferno operating system. Alex that was initially a part of the Plan 9 operating system is the predecessor of Limbo.

Pict

It is a statically typed programming language, which is in the experimental stage today.

SALSA

Short for Simple Actor Language System and Architecture, SALSA supports concurrent programming, message passing, and distributed computing. It uses Java code for portability.

SR

Acronym of Synchronizing Resources, SR is a concurrent programming language.

OBJECT-ORIENTED PROGRAMMING LANGUAGES

Object-oriented programming (OOP) *is a programming paradigm based on the concept of "objects", which may contain data, in the form of fields, often known as attributes; and code, in the form of procedures, often known as methods. In OOP, computer programs are designed by making them out of objects that interact with one another. (Wikipedia)*

Agora

It is a prototype-based object-oriented programming language that features message passing mechanisms.

BETA

It is an object-oriented programming language wherein classes and procedures revolve around the same concept and classes are defined as attributes of objects. It has strong abstraction mechanisms. BETA also supports nested classes.

Cecil

This object-oriented language was created by Craig Chambers at the University of Washington. It is similar to Objective-C and Modula-3.

Lava

Lava is a visual object-oriented interpreter-based programming language.

Lisaac

It was the first compiled object-oriented programming language that was based on prototype concepts. It also supports system programming.

MOO

It is a dynamically typed prototype-based programming language that supports object-oriented programming. It supports exception handling mechanisms and looping constructs.

Moto

It is an open source server-side programming language that comes with state and session management objects and database connectivity.

Object-Z

It was developed at the University of Queensland, Australia. It extends the Z programming language by adding object-oriented features to it.

Obliq

It is an interpreted computer programming language that offers object-oriented programming features. It supports untyped variables and was designed for distributed and multithreaded computations.

Oxygene

Based on Object Pascal, Oxygene is an object-oriented programming language with a rich feature set. Previously, it was known as ‘Chrome’.

Pliant

It is based on a dynamic compiler and comes with a unique ability of supporting low-level instruction lists as well as high-level expressions.

Prograph

It is a visual object-oriented multi-paradigm language that uses symbols to signify the actions to be performed on data.

REBOL

REBOL is the acronym given to Relative Expression Based Object Language. It is designed for use on distributed platforms and in network communications.

Scala

The name Scala stands for Scalable Language. It is a multi-paradigm programming language, which offers object-oriented and functional programming features.

Self

It is an object-oriented prototype-based computer programming language. NewtonScript is used to write programs for Apple Newton and is largely influenced by Self.

Slate

This object-oriented programming language is based on the concept of prototypes. It derives some of its features from Smalltalk and some from the Self language. The Slate design is intended at providing the programmers with an operating system-like environment.

XOTcl

It is an object-oriented extension of the Tool Command Language that supports metaclasses and dynamic classes and methods.

IO

It is a pure object-oriented programming language having a prototype-based object model. It is small in size and can be executed on small portable virtual machines.

Most commonly used Programming Language

As we all know, the programming language makes our life simpler. Currently, all sectors (like education, hospitals, banks, automobiles, and more) completely depend upon the programming language.

There are dozens of programming languages used by the industries. Some most widely used programming languages are given below -

1. Python

Python is one of the most widely used user-friendly programming languages. It is an open-source and easy to learn programming language developed in the 1990s. It is mostly used in Machine learning, Artificial intelligence, Big Data, GUI based desktop applications, and Robotics.

Advantages

- Python is easy to read, easy to understand, and easy to write.
- It integrates with other programming languages like C, C++, and Java.
- Python executes code line-by-line, so it is easy for the programmer to find the error that occurred in the code.
- Python is platform-independent means you can write code once and run it anywhere.

Disadvantages

- Python is not suitable for developing mobile applications and games.
- Python works with the interpreter. That's why it is slower than other programming languages like C and C++.

2. Java

Java is a simple, secure, platform-independent, reliable, architecture-neutral high-level programming language **developed by Sun Microsystems in 1995**. Now, Java is owned by Oracle. It is mainly used to develop bank, retail, information technology, android, big data, research community, web, and desktop applications.

Advantages

- Java is easy to write, compile, learn, and debug as compared to other programming languages.
- It provides an ability to run the same program on different platforms.
- It is a highly secured programming language because in java, there is no concept of explicit pointers.
- It is capable of performing multiple tasks at the same time.

Disadvantages

- Java consumes more memory and slower than other programming languages like C or C++.
- It does not provide a backup facility.

3. C

C is a **popular, simple, and flexible general-purpose computer programming language. Dennis M Ritchie develops it in 1972** at AT&T. It is a combination of both low-level programming language as well as a high-level programming language. It is used to design applications like **Text Editors, Compilers, Network devices, and many more**.

File: main.c

```
1. #include <stdio.h>
2. int main() {
3. printf("Hello C Programming\n");
4. return 0;
5. }
```

Advantages

- C language is easy to learn.
- It is fast, efficient, portable, easy to extend, powerful, and flexible programming language.
- It is used to perform complex calculations and operations such as MATLAB.
- It provides dynamic memory allocation to allocate memory at the run time.

Disadvantages

- In the C programming language, it is very difficult to find the errors.
- C does not support the concepts of constructors, destructors, abstraction, polymorphism, encapsulation, and namespace like OOPs.

4. C++

C++ is one of the thousands of programming languages that we use to develop software. C++ programming language is developed by **BjarneStroustrup in 1980**. It is similar to the C programming language but also includes some additional features such as **exception handling, object-oriented programming, type checking, etc**.

Advantages

- C++ is a simple and portable structured programming language.
- It supports OOPs features such as Abstraction, Inheritance, Encapsulation.
- It provides high-level abstraction and useful for a low-level programming language, and more efficient for general-purpose.
- C++ is more compatible with the C language.

Disadvantages

- C++ programming language is not secured as compared to other programming languages like Java or Python.
- C++ can not support garbage collection.
- It is difficult to debug large as well as complex web applications.

5. C#

C# (**pronounced as C sharp**) is a modern, general-purpose, and object-oriented programming language used with XML based Web services on the .NET platform. It is mainly designed to improve productivity in web applications. It is easier to learn for those users who have sufficient knowledge of common programming languages like C, C++, or Java.

Advantages

- C# is a modern, type-safe, easy, fast, and open-source programming language that is easily integrated with Windows.
- The maintenance of C# (C sharp) is lower than the C++ programming language.
- C# is a pure object-oriented programming language.
- C# includes a strong memory backup facility. That's why it avoids the problem of memory leakage.

Disadvantages

- C# is less flexible because it is completely based on Microsoft .Net framework.

- In C#, it is difficult to write, understand, debug, and maintain multithreaded applications.

6. JavaScript

JavaScript is a type of **scripting language** that is used on both client-side as well as a server-side. It is developed in the **1990s** for the Netscape Navigator web browser. It allows programmers to implement complex features to make web pages alive. It helps programmers to create dynamic websites, servers, mobile applications, animated graphics, games, and more.

Advantage

- JavaScript helps us to add behavior and interactivity on the web page.
- It can be used to decrease the loading time from the server.
- It has the ability to create attractive, dynamic websites, and rich interfaces.
- JavaScript is a simple, versatile, and lightweight programming language.
- JavaScript and its syntax are easy to understand.

Disadvantage

- JavaScript is completely based on the browser.
- It does not support multiple inheritance.
- It is less secure compared to other programming languages.

7. R

Currently, R programming is one of the popular programming languages that is used in **data analytics, scientific research, machine learning algorithms, and statistical computing.** It is developed in 1993 by Ross Ihaka and Robert Gentleman. It helps marketers and data scientists to easily analyze, present, and visualize data.

Advantages

- R programming provides extensive support for Data Wrangling.
- It provides an easy-to-use interface.
- It runs on any platform like Windows, Linux, and Mac.

- It is an open-source and platform-independent programming language.

Disadvantages

- R programming does not support 3D graphics.
- It is slower than other programming languages.

8. PHP

PHP stands for **Hypertext Preprocessor**. It is an open-source, powerful server-side scripting language mainly used to create static as well as dynamic websites. It is developed by **Rasmus Laird in 1994**. Inside the php, we can also write HTML, CSS, and JavaScript code. To save php file, file extension .php is used.

Advantages

- PHP is a more secure and easy-to-use programming language.
- It supports powerful online libraries.
- It can be run on a variety of operating systems such as Windows, Linux, and Mac.
- It provides excellent compatibility with cloud services.

Disadvantages

- PHP is not capable of handling a large number of applications and not suitable for large applications.
- It is quite difficult to maintain.

9. Go

Go or Golang is an **open-source programming language**. It is used to build simple, reliable, and efficient software. It is developed by **Robert Griesemer, Rob Pike, and Ken Thompson in 2007**.

Advantages

- Go language is easy-to-learn and use.
- It comes with the in-built testing tools.
- Go is a fast programming language.

Disadvantages

- Go language does not support generics.
- It does not support error handling.
- It supports a lack of frameworks.

10. Ruby

Ruby is an open-source, general-purpose, and pure object-oriented programming language released in **1993**. It is used in front-end and back-end web development. It is mainly **designed to write CGI (Common Gateway Interface) scripts**.

Advantages

- Ruby supports various GUI (Graphical User Interface) tools like GTK and OpenGL.
- It is used to develop both internet as well as intranet applications.
- The code written in Ruby is small and contains less number of lines.

Disadvantages

- Ruby is slower than other programming languages.
- It is very difficult for programmers to debug the code written in Ruby.

A Categorical List of programming languages

- Last Updated : 17 Nov, 2021

Programming languages are the formal language, with a set of instructions which provides the desired output. For implementing various algorithms in our machines we started using the Programming language. A set of specific instructions are used in programmable machines, rather than general programming languages. Computer programming languages are used to communicate with a computer. Each and every Programming language are based on certain syntactic and semantic rules.

Computers work with digital representation. only understand the presence of a 0 or 1 as off or on. So to communicate with the computers we have to give the instruction in Binary which is nearly impossible, so here comes the programming language to save us. we wrote the instructions in English following some general syntactical rules of a programming language and later this transformed into the machine code by some process and tells the computer to do some specific operation.

Day by day the rising demands for computing power and productivity was the key factor for the development of more powerful, cheaper, and faster business machines, supercomputers, and various programmed devices, with the variety of applications and types of computers, every time there arouses a need for specific programming languages to complete specific tasks. A complete categorical list of all types of programming languages is given below. There is no strict classification scheme for programming languages. Thus, we can see a language as an example of more than one programming language.

Let's Understand these programming languages one by one. As the list is very large so it is impossible to discuss all of these in details. Here I'm writing the brief introduction with example for all of these various programming languages.

1. **Compiled Languages:**
   A compiled language is a programming language in which we use a compiler to compile and execute our code. the compilers are generally translators that generate machine level code from our written source code.
   Example:
   - C
   - C++
   - C#
   - ALGOL
   - Cobol
   - Fortran
   - Java
   - Visual Basic
   - Smalltalk
2. **Interpreted Languages:**
   An interpreted language is a programming language in which without compiling a program into machine-language instructions we can execute instructions directly and freely. The interpreter executes the program line by line.Interpreted a language gives many additional flexibility over compiled implementations like, platform independence, dynamic scoping, dynamic typing etc.
   Example:
   - Python
   - Ruby
   - Perl
   - Pascal
   - Lisp

- BASIC
- APL

3. **Scripting Languages:**
   Scripting languages are programming languages that control an application. Scripts which can be executed independently over any other application. They are widely used in the application that they control and are used in automation.
   Example:
   - PHP
   - VBScript
   - Windows PowerShell
   - F-Script
   - BeanShell
   - AutoIt
   - R
   - Game Maker Language
4. **Markup Languages:**
   A markup language is an artificial language that used for annotating a document so that it is syntactically distinguishable from the text, the text that define how the text is to be displayed.
   Example:
   - HTML
   - XML
   - XHTML
   - SGML
   - Curl
5. **Procedural Languages:**
   Procedural (imperative) programming implies specifying the steps that the programs should take to reach to an intended state. A procedure is nothing but a set of instructions that can be referenced through a procedure call. this help in the reuse of code. This type of programming makes the programs structured and easily traceable for program flow.
   Example:
   - HyperTalk
   - Go
   - PL/C
   - PL/I
   - MATLAB
   - Curl
   - Mathematica
   - MATLAB
6. **Functional Languages:**
   Functional programming languages define every computation as a mathematical evaluation. They focus on the application of functions.Some of the functional programming languages are pure functional language but many so-called functional languages are impure, containing imperative features, they are not pure function languages.
   Example:
   - Pure Functional
   - Agda
   - SAC
   - SASL
   - Cuneiform
   - Curry
   - Futhark
   - Haskell
7. **Impure Functional languages:**

- APL
- C++ (since C++11)
- C#
- VB.NET
- Ceylon
- Kotlin
- Lisp
- Clojure
- JScript
- PHP
- Python

8. **Logic-based Programming Languages:**
   Logic programming is a type of programming paradigm which is largely based on formal logic. logic -based programming are set of sentences in logical form, which express facts and rules about a problem domain.
   Example:
   - Prolog
   - ROOP
   - ALF
   - Alma-0
   - Curry
   - Fril
   - Janus
9. **Object-Oriented Languages:**
   Object-oriented programming (OOP) is a high-level programming paradigm based on the concept of “objects”, which may contain data, in the form of fields, often known as attributes. In OOP, computer programs binds related data and functions into an object and implements objects and their associated procedures to create software programs.
   Example:
   - Scala
   - C++
   - Java
   - Python
   - C#
   - Ruby
   - Scala
10. **Dataflow languages:**
    Dataflow programming languages rely on representing the flow of data. In a dataflow language, a stream of data gets passed from instruction to instruction for execution. The Conditional execution jumps the data and in procedure calls, it routes the data to a different location.
    Examples:
    - Analytica
    - BMDFM
    - Hartmann pipelines
    - Lucid
    - Max
    - Oz
    - Prograph
    - Pure Data
11. **Embeddable languages:**
    It is mainly dynamic scripting and programming language. it can be also used as a platform-independent general-purpose programming language. Embedded languages are of two types:
    1. Server Side

2. Client Side
3. **Server-side**
    - PHP
    - VBScript
    - SMX
    - Tcl
    - WebDNA
4. **Client side**
    - ActionScript
    - JavaScript
    - VBScript

Machine languages:

These languages are directly executable by a compute Central Processing Unit. Machine languages are typically coded in bit patterns, represented in octal or hexadecimal forms.

Example:

- ARM
- DEC
- x86
- IBM System/360
- MIPS
- Sun, Oracle SPARC

System languages:

These are for low-level languages used in memory management or task management. A system programming language generally used for system programming, for example, languages designed for writing system software, usually require different approaches of development compared to application software.

Example:

- Ada
- Nim
- Rust
- Swift
- ESPOL

Concurrent Languages:

These languages are constructed for concurrency in Message passing languages. For example, Java shows shared-memory concurrency.

Example:

- Go
- Java
- Julia
- clojure
- Scala

Multiparadigm languages:

These types of languages support more than one programming languages or programming paradigm. Multiparadigm languages allow using more than one programming style. No specific language solves all the problems in the easiest or efficient that's why we use Multiparadigm languages.

Example:

- Ada
- APL
- BETA
- C++
- C#
- Cobra

Extension languages:
These languages are used as an extension to other languages. Extension programming languages are embedded into another program and used to harness its features in extension scripts.
Example:

- AutoLISP
- BeanShell
- Perl
- Pike
- Ruby

Iterative languages :
These languages are built around or offering generators.

Example:

- Aldor
- Alphard
- PHP
- CLU
- Cobra

Hardware description languages:
These programming languages are used in electronics, a hardware description language or HDL is used to describe the structure, design, and operation of electronic circuits or digital logic circuits. Amoung various most popular and well-supported HDL varieties used in industry are Verilog and VHDL.
Example:

- Analog circuit's HDLs:
    - Verilog-AMS
    - VHDL-AMS
- Digital circuit's HDLs
    - Advanced Boolean Expression Language(ABEL)
    - Altera Hardware Description Language(AHDL)
    - Bluespec
    - Lava
    - ELLA

Visual languages:
In Visual Languages users can specify programs in a 2-D or more way instead one-dimensional (text strings) in visual languages we use graphical elements and figures to develop a program.
Example:

- Analytica
- Blockly
- DRAKON
- Fabrik
- Scratch
- Simulink
- Spreadsheets

List-based languages:
List-based languages are based on the list data structure.
Example:

- Lisp
- Arc
- Clojure
- R
- Dylan

- Joy

Synchronous languages:
These programming languages are used in programming reactive systems. A programming reactive systems is the systems which gets interrupted and respond instantly. some of these systems are also called real-time systems and are used widely.
Example:

- Argus
- Averest
- Esterel
- Lustre
- Signal

Macro languages:
These languages are used to transform one source code file into another. Macro is a short piece of text which can expands into a larger one. Macro languages are often used to preprocess the source code. Preprocessors supply facilities like file inclusion etc.

Example:

- cpp (the C preprocessor)
- m4
- ML/I (general purpose macro processor)

Query languages:
These languages are used in databases and information systems to make queries.
Example:

- SQL
- XPath
- AQL
- PQL
- XQuery

Metaprogramming languages:
Metaprogramming is the writing of programs that write or manipulate other programs, including themselves, as their data or that do part of the work that is otherwise done at run time during compile time.
Example:

- C++
- CWIC
- Curl
- D
- eC
- Emacs Lisp
- Elixir
- F#

Rule-based languages:
Rule-based languages instantiate rules when activated by conditions in a set of data. Some set which gets selected and the statements which belonged to those rules get executed.
Example:

- awk
- CLIPS
- Constraint Handling Rules
- Drools

- Jess
- OPS5
- Prolog

Numerical analysis Languages:
In Numerical analysis we analyzes and implements algorithms for numerical solutions to solve huge problems of realistic mathematical models involving continuous variables. we use the following programming languages in Numerical Analysis.
Example:
- Mathematica
- MATLAB
- PROSE
- R

Syntax handling languages:
These languages assist with generating lexical analyzers and parsers for context-free grammars.**Example:**
- ANTLR
- Coco/R (EBNF with semantics)
- GNU bison (FSF's version of Yacc)
- GNU Flex (FSF version of Lex)
- lex (Lexical Analysis, from Bell Labs)
- Parsing expression grammar (PEG)

Non-English-based languages:
There are several programming languages which are developed in different language other than the English language. Language is not a barrier in this case.
- Chinese BASIC – Chinese
- Fjölnir – Icelandic
- Language Symbolique d'Enseignement – French
- Lexico – Spanish
- Rapira – Russian
- ChaScript-Bengali
- ezhil-Tamil

XML-based languages:
These languages are used to transfer XML documents to into human readable format.
- Ant
- C?
- XPath
- XQuery
- XProc