

Comparative Study of the Programming Languages

Ruchi Sharma¹, A.J Singh²

Research Scholar, Department of Computer Science, Himachal Pradesh University, Shimla, India¹

Professor, Department of Computer Science, Himachal Pradesh University, Shimla, India²

Abstract: With the rapid development of software industry, additional and more individuals need to learn programming languages. But today there are a more than three hundred programming languages accessible, only a few of them will be applied relatively wide. In this study, the research in programming language was conducted. Three of the most widespread programming languages C, C# and Java are chosen to be the objects to study.

Keywords: C, Java, C#, Programming Languages.

I. INTRODUCTION

A programming language is a notational system for describing computation in machine-readable and human-readable form [1]. Any notation for the description of algorithms and data structures may be termed as programming language [2].

Programming languages have been a desirable and productive area of study. Programmers endlessly debate the relative deserves of their favourite programming languages, sometimes with nearly non secular zeal. On a more tutorial level, computer scientists search for ways in which to style programming languages that mix communicative power with simplicity and potency. Programming language designs and implementation methods have evolved continuously since the earliest high-level languages appeared in 1950s.

The C Programming Language

C is a programming language developed at AT& T's Bell Laboratories of USA in 1972. It was designed and written by a man named Dennis Ritchie. In the late seventies C began to replace the more familiar languages of that time like PL/I, ALGOL, etc. C becomes very popular because it is reliable, simple and easy to use. Moreover, in an industry where newer languages, tools and technologies emerge and vanish day in and day out, a language that has survived for more than 3 decades has to be really good [3].

The C# Programming Language

C# was created at Microsoft late in the 1990s and was part of Microsoft's overall .NET strategy. It was first released in its alpha version in the middle of 2000. C#'s chief architect was Anders Hejlsberg. The grandfather of C# is C. From C, C# derives its syntax, many of its keywords, and its operators. C# is a new computer-programming language developed by Microsoft Corporation, USA. C# is a fully object-oriented language and is the first component-oriented language. It has designed to support the key features of .Net framework. It is simple, efficient,

productive and type-safe language derived from the popular C language. Although it belongs to the family of C, it is purely object-oriented, modern language suitable for developing Web-based applications. C# is designed for building robust, reliable and durable components to handle real world applications [5].

The JAVA Programming Language

Java was conceived by James Gosling, Patrick Naughton, Chris Warth, Ed Frank, and Mike Sheridan at Sun Microsystems, Inc. in 1991. It took 18 months to develop the first working version. This language was initially called "Oak," but was renamed "Java" in 1995. Object-oriented programming (OOP) is at the core of Java. In fact, all Java programs are to at least some extent object-oriented. All computer programs consist of two elements: code and data. Furthermore, a program can be conceptually organized around its code or around its data.

That is, some programs are written around "what is happening" and others are written around "who is being affected." These are the two paradigms that govern how a program is constructed. The first way is called the process-oriented model. This approach characterizes a program as a series of linear steps (that is, code). The process-oriented model can be thought of as code acting on data. To manage increasing complexity, the second approach, called object-oriented programming, was conceived. Object-oriented programming organizes a program around its data (that is, objects) and a set of well-defined interfaces to that data. An object-oriented program can be characterized as data controlling access to code [4].

II. LANGUAGE PARADIGMS

Procedural programming is the traditional programming paradigm that's supported the construct of functions and functions calls. These functions often facilitate to divide the system into varied modules, and thus produce a

structure for the same program. Procedural languages will use a outlined set of directions to accomplish a task, and often use a “main” perform that then will decision a spread of alternative functions so as to complete a task. As a result of this language like C is taken into account procedural. The structure of procedural programs has several key options. Procedures in these programs are utterly freelance of every alternative. Any data that a procedure needs in order to complete its operations should be passed to that at the time it's referred to as. Due to this, data used by these procedures should be prepared to be used before the procedures is referred to as, as there is no thanks to pass data to a procedure once it's started running.

C# is a multi-paradigm programming language encompassing strong typewriting, imperative declarative, functional, generic, object-oriented and component-oriented programming disciplines. C# is one of the programming languages designed for the common language infrastructure. At the center of C# is object-oriented programming (OOP). The object-oriented methodology is inseparable from C#, and all C# programs are to a minimum of some extent object orientated. C# can be applied to the applying development as a result of C# could be a speedy application development (RAD) language. It can scale back the amount of the applying development considerably. Furthermore C# is conjointly terribly appropriate for the event of internet application as a result of C# consists of an oversized framework of pre-developed parts which might change the code of internet applications.

Java is a pure object-oriented programming language. It makes modular programs on the market in order to utilize the code. Java is open source. People will use it for free. It is also platform-independent, which is one of the foremost important benefits of Java. Programs written in Java can simply move from one pc system to a different. Java also has some disadvantages. Java is a memory-consuming programming language. Java is slow because it has an additional layer between the systems and therefore the programs. The extra layer is Java Virtual Machine (JVM).

Anything done by the Java programs has to be dead by the Java Virtual Machine. Then it makes the system to do the particular instructions. Java has three completely different forms, Java 2 customary Edition (J2SE), Java2 Micro Edition (J2ME), and Java2 Enterprise Edition (J2EE).

III. CRITERIA FOR A GOOD LANGUAGE

- To begin the language selection process, it is important to establish some criteria for what makes a language good. A good language choice should provide a path into the future in a number of important ways:
- Its definition should be independent of any particular hardware or operating system.
- Its definition should be standardized, and compiler implementations should comply with this standard.

- It should support software engineering technology, discouraging or prohibiting poor practices, and promoting or supporting maintenance activities.
- It should effectively support the application domain(s) of interest.
- It should support the required level of system reliability and safety.
- Its compiler implementations should be commensurate with the current state of technology.

IV. COMPARISON OF C, C# AND JAVA FROM THEORETICAL ASPECTS

1). Data varieties and Sizes: “Some common varieties of knowledge varieties are employed in the programming languages known as because the primitive varieties like characters, integers floating point numbers etc.” In C, Java and C#, all variables must be declared before they are used, usually at the starting of theperform before any feasible statements.

C

In C Language, There are four basic knowledge kind. Basic data kind in C language.

1. int- “an integer, typically reflective the natural size of integers on the host machine”
2. float -“single-precision floating point”
3. double- “double-precision floating point”
4. char- “a single byte, capable of holding one character in the local character set”

There are 5 kind Specifiers in C programming

- a) long
- b) longlong
- c) short
- d) unsigned
- e) signed

There are thirty two reserved keywords in C language. “These keywords cannot be abbreviated, used as variable names, or used as any other kind of identifiers.” In C, every knowledge kind such as a personality, integer, or floating-point number encompasses a vary of values related to it. The range is determined by the quantity of storage that's allotted to store a selected kind of knowledge within the memory of the pc. It depends on the computer you're running. This feature for C language is called “machine dependent”. For example, an number may take up thirty two bits on your laptop, or perhaps it may be hold on in sixty four bits on another laptop. Don't write any program that assumes the size of the info types in C.

C#

In C#, the Boolean kind will solely have 2 values: true or false. Integral Types in c# is additionally completely different from C. In C the integral kind is solely one type. But “in C#, an integral is a class of varieties. They are whole numbers, either signed or unsigned, and the char type. The char type is a Unicode character, as defined by the Unicode Standard”. There are abundant additional key

words in C# than those in C. There are total eighty seven reserved keywords in C#.

Java

The Boolean kind in Java is as the same as that in C#. There are solely 2 values on the market for Boolean kind, true and false. Integral Types in Java is completely different from C and it is just like C#. In C#, an integral is a class consists of nine knowledge varieties. In Java, there are 5 knowledge varieties that will have the integral worth. There is no sbyte, uint, ulong data kind in Java any additional.

2). String type: In C language, there is no string type. The char kind of array is employed rather than String type. "In C# and Java, the data kind String is treated as reference kind. Instance of Strings are treated as (immutable) objects in each languages, but support for string literals provides a specialised suggests that of constructing them. C# also permits verbatim strings for quotation while not escape sequences, which additionally enable newlines."

3). Structure: The structure in C language has
1. C Structure can solely contain knowledge things
2. In C language, using 'struct' keyword is necessary to form a variable.

"On the contrary, in C#, structs have significant distinction from categories. "Structs in C# are designed to encapsulate light-weight weight objects. They are worth varieties (not reference types), so they are passed by worth. In addition, they have limitations that don't apply to classes. On the other hand, struct is terribly appropriate for employing a category with very tiny instance if you do not care that "the struct is sealed" and you do not care "value semantics". "Structs are additional economical than categories thus they are good for the creation of light-weight weight objects."

In C#, a struct can additionally be a price kind as associate as a part of object or store in associate array. Java does not have struct worth kind.

4). Inheritance: Inheritance means making a new category derives from the prevailing category. The derived category inherits all the variables and strategies from base class. Overriding strategies and properties will extend the practicality of base category. C language does not support inheritance as a result of it's not object-oriented language. Neither C# nor Java allows multiple inheritance that suggests that every category will solely inherit from only 1 category. However, both C# and Java supports multiple implementations of interfaces. "Furthermore, C# structs do not support inheritance, and do not support explicit default constructors (one is provided by default)".

5). Array: "In C, each sub-array of a flat array should have the same dimensions. In Java and C# arrays do not

got to be uniform because jagged arrays is created as one-dimensional arrays of arrays. In a jagged array the contents of the array are arrays which can hold instances of a kind or references to alternative arrays." In C#, multidimensional and jagged arrays have the important distinction. "A flat array is akin to a multidimensional array in C that's a contiguous block containing members of constant kind. A jagged array is akin to associate array in Java that is an array of arrays, meaning that it contains references to alternative arrays that might contain members of constant kind or alternative arrays counting on what percentage levels the array has."

6). Reference and Value Types: "Primitive varieties ar the basic kinds of knowledge, such as byte, short, int, long, float, double, boolean, char. Reference types are any instantiable category as well as arrays, such as String, Scanner, Random, Die, int[], String[], etc." Both in C# and Java, the idea of reference kind is supported. In C#, value varieties and reference varieties that have important distinction. The situation of primitive varieties and reference varieties is strictly constant as that in C#. Simple varieties (int, long, double, and so on) and structs are worth varieties in C#. There is no value varieties and reference varieties in C.

7). Pointer: "A pointer is a variable containing the address of another variable." In C, pointer can be used as arrays, Strings, writeable function parameters and improvement. In C# pointer can solely be declared to hold the memory address of import varieties and arrays. For safety reasons, Java does not support pointers or pointer-arithmetic to be used the least bit.

8). Partial classes: "C# allows a class definition to be split across many supply files employing a feature known as partial categories. Each half should be marked with the keyword partial." This function is not on the market in C and Java. In Java, an error concerning redefining already-defined categories was given.

Table 1: Programming Languages and important features they Support

Language	C	C#	Java
Paradigm	Imperative (procedural), structured	Object-Oriented	Multi-paradigm, Imperative, declarative, functional, generic, object-oriented
Syntax	Complex	Easiest	Moderate
Keyword	32	50	87
Static / Dynamic typing	Static	Static	Static

Approach used	Top down approach	Bottom up approach	Bottom up approach
Concepts of overloading	Doesn't support overloading	Support overloading	Support overloading
Built-In Security	No	Yes	Yes
Inheritance feature	No such feature	Support all types of inheritance excluding multiple inheritance	Support all types of inheritance excluding multiple inheritance

V.CONCLUSION

It can be concluded that each one three languages C, C# and Java have the advantages and drawbacks. It is really difficult to mention that one is best than the others and that one is quicker than the others. But all three programming languages have their most appropriate fields to use. People will get quick and stable performance from the code written in a appropriate programming language.

REFERENCES

- [1] Kenneth C. Louden, Programming Languages Principles and Practice, San Jose State University.
- [2] Terrence W. Pratt and Marvin V. Zelkowitz, Programming Languages Design and Implementation, Prentice Hall, Inc.
- [3] Yashavant P. Kanetkar, Let Us C.
- [4] Herbert Schildt, The Complete Reference Java 2, Tata McGraw-Hill.
- [5] Herbert Schildt, The Complete Reference C# 4.0, Tata McGraw-Hill.
- [6] Linda Melver and Damian Conlway, "Seven Deadly Sins of Introductory programming language Design", Monash University, Victoria, Astralia, IEEE-1996.
- [7] P. Kulkarni, H.D. Kailash, V. Shankar, S. Nagarajan and D.L. Goutham, "Programming Languages: A Comparative Study", Information Security Research Lab, NITK, Surathkal.
- [8] Lutz Prechelt, "An Empirical Comparison of Seven Programming Languages", IEEE-2000.
- [9] B. Bates, "C# as a First Language: A Comparison with C++". Journal of Computing Sciences in Colleges, Volume 19 Issue 3, 2004.
- [10] Manpreet Singh, Harmanpreet Singh Saluja, Priyanka Talwar and Amandeep Kaur, "Comparison of OO Programming Languages", International Journal of Advanced Research in Computer Science and Software Engineering, Volume 5, Issue 8, 2015.