

C Programming Language - Still Ruling the World

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Abstract: *C Programming Language, developed by Dennis Ritchie in 1972 is an evergreen programming language. It is the backbone of the Unix operating system and paved the way for the development of object-oriented programming. C has been around for 30 years, and there is a ton of source code available. This means there's a lot to learn from, and a lot to use. C programming language is that which sits close to the operating system. This feature makes it an efficient language because system level resources, such as memory, can be accessed easily. This language has features like it is a fast, flexible, portable and structured programming language having a rich library making the C programming language not to have an expiry date. C programming language's closeness to the hardware, great portability makes it ideal for low level development for things such as operating systems, kernels and embedded systems. Its versatility, efficiency and good performance makes it an excellent choice for high complexity data manipulation software, like databases or 3D animation. The fact is, that many programming languages today are better than C for their intended use which doesn't mean that they beat C in all areas. C is still unsurpassed when performance is the priority. The C programming language is a general-purpose language with almost endless applications like in operating systems, language compilers, network drivers, language interpreters, and system utilities areas of development. Even today Facebook uses C and C++ in their applications because of its lower disk space usage and performance. The world is running on C-powered devices. C is the past, the present, the future in many areas of software. Hence, the C programming language is the lingua franca of programming. Hence, it can be concluded that C PROGRAMMING LANGUAGE – STILL RULING THE WORLD!*

Survey: A standard procedure of an Empirical Research Methodology was used to conduct the survey where 623 respondents from various parts of the globe participated. From the survey, it was concluded that 79.9% of the respondents felt that C programming language is ruling the world till date.

Keywords: C Language, Programming, Importance

1. Introduction

C is a programming language which is one of the oldest and finest programming languages. The C Language was developed by Dennis Ritchie in 1972¹ for creating system applications that directly interact with the hardware devices such as drivers, kernels², etc. C programming is considered as the base for other programming languages, which is why it is known as mother language. C is a System programming language, Procedural-oriented programming language, Structured programming language, Mid-level programming language, Compiled and Complete programming Language.

C, a successor to the programming language B³, was developed at the Bell Laboratories⁴ implemented on the DEC PDP-11⁵ computer. It was applied for re-implementing the kernel of the UNIX⁶ operating system. During the 1980s, C had become one of the most widely used programming languages. C has been standardized by ANSI⁷ since 1989

(ANSI C) and by the International Organization for Standardization (ISO).

C is an imperative procedural language, very flexible and versatile, allowing maximum control with minimal commands. It was designed to be compiled to provide low-level access to memory and language constructs that map efficiently to machine instructions.

C is a language which is rich in library functions, extensible, faster and also has good memory management. Due to the following features -major parts of operating systems like Windows, Linux, Oracle, Android are written in C.C is used to write driver programs for devices like Printers, Tablets, etc. C is used to program embedded systems where programs need to run faster in limited memory. C is also used to develop games.

C has both directly and indirectly influenced many latest programming languages such as C++, C#, Unix's C shell, D, Go, Java, JavaScript, Julia, Limbo, LPC, ObjectiveC, Perl, PHP, Python, Ruby, Rust, Swift, Verilog, SystemVerilog, etc in which the most pervasive influence was the C programming Language's syntax. Hence making C programming language as the ruling language in the world till date.

Perceptions of Few Professionals:

- "The kind of programming that C provides will probably remain similar absolutely or slowly decline in usage, but relatively, JavaScript or its variants, or XML, will continue to become more central."~ **Dennis Ritchie** (Computer Scientist, Bell Labs, New Jersey, USA)

¹Reema Tharaja "Introduction to C Programming", Second Edition, OXFORD Press, 2015.

²M.T. Somashekar "Problem Solving with C", 2nd Edition, Prentice Hall India Learning Private Limited 2018

³Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.

⁴C From Theory to Practice Second Edition 2017 by George S. Tselikis, Nikolaos D. Tselikas, Taylor and Francis

⁵Byron Gottfried, Schaum's Outline of Programming with C", Mc Graw-Hill.

⁶E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.

⁷[https://en.wikipedia.org/wiki/C_\(programming_language\)](https://en.wikipedia.org/wiki/C_(programming_language))

- “C: A programming language that is sort of like Pascal except more like assembly except that it isn't very much like either one, or anything else. It is either the best language available to the art today, or it isn't.” ~ **Raymond Simard** (Former Clerk of the House of Commons of Canada, Canada)
- “Java is, in many ways, C++-.”

Michael Feldman (Communications Consultant, The Glover Park Group, USA)

- “Assembly, while extremely powerful, is simply too difficult to program large applications and hard to read or interpret in a logical way. C is a compiled language, which creates fast and efficient executable files. It is also a small “what you see is all you get language:” ~ (Wiki Books, C Programming)
- “C++ would make a decent teaching language if we could teach the ++ part without the C part.” ~ **Dr. Michael B. Feldman** (Professor Emeritus Department of Computer Science, The George Washington University, Washington, DC)

2. Review of Literature

C language is one of the easiest languages to learn. People all over the world prefer C language to begin their programming because it is easy to understand and has easy syntaxes⁸. Moreover, C language has fixed number of keywords⁹ which are 32¹⁰ long with the fixed set of control primitives like if¹¹, for¹², while¹³, switch¹⁴ and do while¹⁵. It also includes a set of standard C functions which are commonly used while writing simple as well as complex programs.

One of the main reasons why C has as always been a popular language and is still in use is its portability. With slight modifications, one can run a C program in any other platform or computer system. C is a Portable Assembly language. It is as close to the machine as possible while it is almost universally available for all existing processor configurations. Because of which all the compilers¹⁶, libraries, and interpreters¹⁷ of other programming languages are often implemented in C. Many

interpreted languages like Python have their primary implementations written in C.

C is considered as an important programming language because of which it's still ruling the world is: it is a powerful language that includes a collection of in-built functions and operators that help in writing any complex program. C programs are very efficient because they contain a variety of datatypes¹⁸ and robust operators. The capabilities of an assembly language and high-level language are combined together in the C compiler, which makes it the most suitable language for writing system software as well as commercial software.

Despite the prevalence of higher-level languages, the C programming language continues to empower the world. There are plenty of reasons to believe that C programming was, is and will remain active for a long time. Here are some reasons why C is unbeatable:

- 1) **Legacy:** C has been around a long time and virtually anything ever made which can be called a computer includes a C compiler. Even most 'better' programming languages are built on and using C.
- 2) **Portability:** C is the oldest language which can generally be considered cross-platform. Although it requires being recompiled on the target platform, most C source runs exactly the same on any platform.
- 3) **Libraries:** Because C is as old as it is, it has the largest collection of optimized libraries and source code extent. C is the most hyper-efficient Programming language as it is a part of the STL¹⁹ library. Also, one can extend libraries in C while programming.
- 4) **Raw Performance:** Because C is so old, much of it has been optimized to run extremely fast on 10MHz²⁰ 8-bit systems with less than 640k²¹ RAM.
- 5) **Low Level Accessibility:** Due to its age, C includes native support for inline Assembler²² for even greater optimization. No other language (except, C++) offers the full spectrum from high-level abstraction to low-level control.
- 6) **Relationship with Machine Language:** Most modern high-level languages take abstraction to such extremes that even veteran programmers have no real clue of how a CPU actually executes their code. By contrast, C's combination of high-level abstraction and low-level control keeps programmers mindful of precisely how a CPU functions - leading to better, faster, cleaner code.
- 7) **Flexibility:** C programming language is used widely because of the flexibility of its use for the memory management. Programmers of C have opportunities to control how, when, and where to allocate and de-allocate memory. Memory is allocated statically, automatically, or dynamically in C programming with the help of malloc [¹Reema Tharaja “Introduction to C Programming”, Second Edition, OXFORD Press,

⁸Reema Tharaja “Introduction to C Programming”, Second Edition, OXFORD Press, 2015.

⁹Pradeep Deyand Manas Ghosh, “Programming in C”, Oxford Press, 2nd Edition, 2017

¹⁰<https://ict.iitk.ac.in/c-the-mother-of-all-languages/>

¹¹Byron Gottfried, Schaum's Outline of Programming with C”, Mc Graw-Hill.

¹²Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.

¹³M.T. Somashekar “Problem Solving with C”, 2nd Edition, Prentice Hall India Learning Private Limited 2018

¹⁴Pradeep Deyand Manas Ghosh, “Programming in C”, Oxford Press, 2nd Edition, 2017

¹⁵E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.

¹⁶AK Sharma, “Computer Fundamentals and Programming”, 2nd Edition, University Press, 2018

¹⁷C From Theory to Practice Second Edition 2017 by George S. Tselikis, Nikolaos D. Tselikas, Taylor and Francis

¹⁸Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.

¹⁹https://en.wikipedia.org/wiki/Standard_Template_Library

²⁰Google

²¹Google

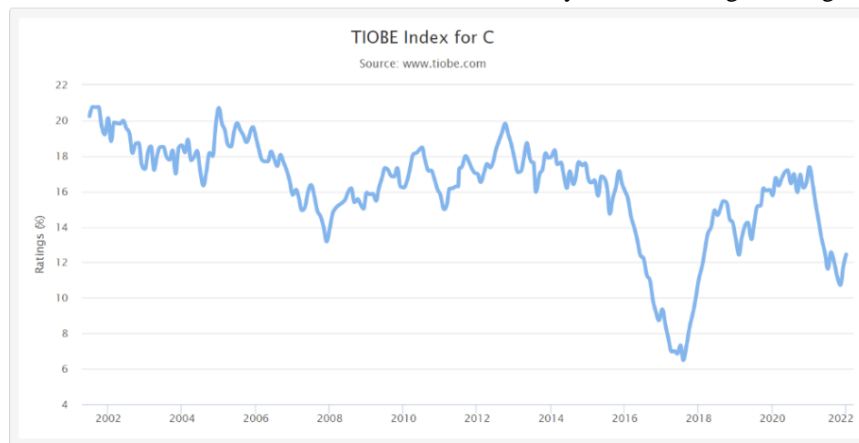
²²AK Sharma, “Computer Fundamentals and Programming”, 2nd Edition, University Press, 2018

2015.] and calloc [C From Theory to Practice Second Edition 2017 by George S. Tselikis, Nikolaos D. Tselikas, Taylor and Francis] functions.

8) **Memory Manipulation:** Arbitrary memory address access and pointer arithmetic is a vital feature that creates C an ideal suited system programming. At the hardware/software boundary, computer systems and microcontrollers map their peripherals and I/O pins into memory addresses. System applications must read and write to those custom memory locations to communicate with the globe. So, C's ability to control arbitrary memory addresses is imperative for system programming.

The TIOBE [<https://www.tiobe.com/tiobe-index/>] (The Importance of Being Earnest) Programming Community index is an indicator of the popularity of programming languages. The ratings are based on a number of skilled engineers world-wide, courses and third-party vendors. Popular search engines such as Google, Bing, Yahoo!, Wikipedia, Amazon, and YouTube are used to calculate the ratings. The index can be used to check whether one's programming skills are still up to date or to make a strategic decision about what programming language should be adopted when starting to build a new software system.

Here, is the graph showing TIOBE ratings throughout different years for C Programming Language:



Here, are the TIOBE indexes for different programming languages:

Programming Language	2022	2017	2012	2007	2002	1997	1992	1987
C	1	2	2	2	1	1	1	1
Python	2	5	8	8	18	28	-	-
Java	3	1	1	1	2	18	-	-
C++	4	3	3	3	3	2	2	4
C#	5	4	4	7	12	-	-	-
Visual Basic	6	14	-	-	-	-	-	-
JavaScript	7	7	10	9	9	21	-	-
Assembly language	8	10	-	-	-	-	-	-
PHP	9	6	5	5	8	-	-	-
SQL	10	-	-	-	35	-	-	-
Prolog	24	33	45	28	29	15	10	3
Ada	28	30	17	17	17	11	3	14
Lisp	32	28	13	13	11	8	12	2
(Visual) Basic	-	-	7	4	4	3	7	5

C Programming Language in Operating Systems: C language was originally developed to write down UNIX software. Also, the execution time of the programs written in C language is reminiscent of the assembly language, which has made C language the foremost crucial part within the development of assorted operating systems. Most of the Operating Systems have lots of their parts implemented in C because its swiftness. Unix-Kernel, Microsoft Windows utilities and OS applications, and an enormous segment of Android have all been written in C language.

many languages “higher” than C will use C to compile. Most of the modern programming languages have their compilers written in C because of C Programming Language’s proximity to the hardware whose response time is way better than high level languages exerting easier control. Embedded systems²³ used in electrical appliances like sensors, Arduino²⁴, etc mostly run on C platform or on a platform whose libraries are coded in C and C++. Also, C Programming Language has also led to development of

Though C is considered a high-level language, it is far closer to the hardware than most other languages. For that reason,

²³<https://www.toptal.com/c/after-all-these-years-the-world-is-still-powered-by-c-programming>

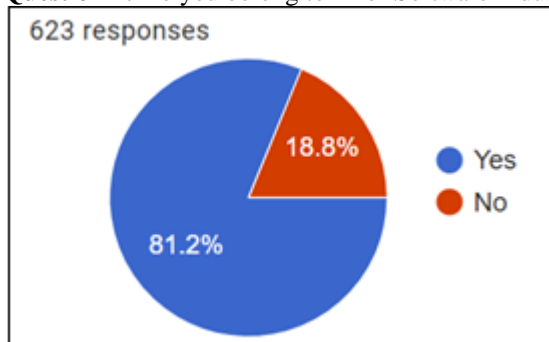
²⁴<https://www.arduino.cc/>

several new languages such as C++, C#, Java, JavaScript, Python, Verilog, etc. C Programming language is also used for creating a variety of graphics and gaming applications.

3. Literature Survey and Results & Discussion

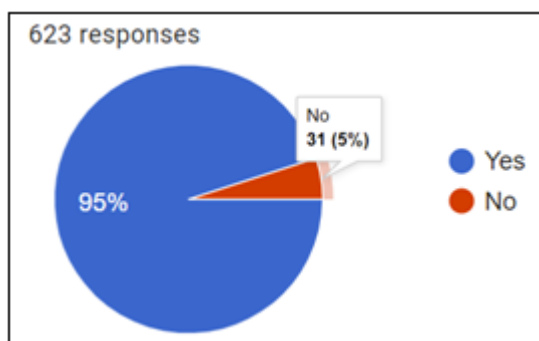
A standard procedure an Empirical Research Methodology was used to conduct the survey on the chosen topic. Demographically, the total number of respondents were 623 among which 364 were Male and 259 were Female. The tools used in performing this survey were: Direct Interaction, Emailing, social media, etc. The respondents were from various parts of the globe like India, USA, UK, China, Singapore, Australia, New Zealand etc. The survey reports were as follows:

Question 1: Do you belong to IT or Software Industry?



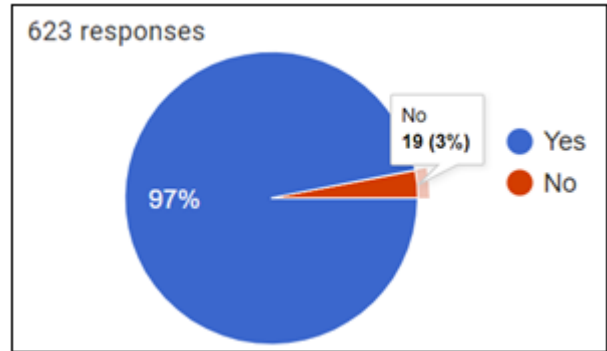
The above pie chart exhibits the result of the survey for the first question which states that 81.2% of the respondents were from the IT or Software industry while 18.8% of the respondents were not.

Question 2: Did you learn C Programming Language?



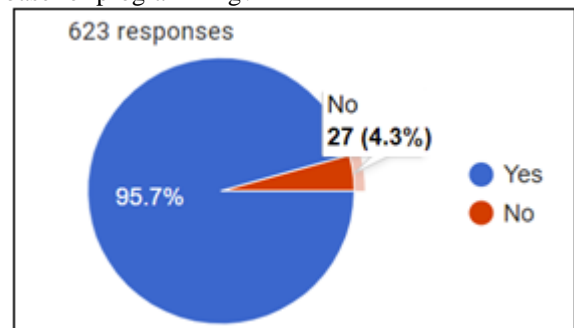
The above pie chart indicates the result of the survey for the second question which states that 95% of the respondents learnt C programming language while 5% of the respondents did not.

Question 3: Do you agree that 'C' Programming language helped in learning other programming languages?



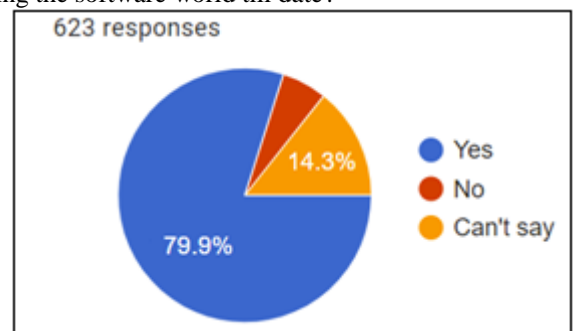
The above pie chart illustrates the result of the survey for the third question which states that for 97% of the respondents, C programming language helped in learning other programming languages while for 3% of the respondents, it did not.

Question 4: Do you think that 'C' Programming language is the base for programming?



The above pie chart demonstrates the result of the survey for the fourth question which states that 95.7% of the respondents thought that C programming language is the base for programming while 4.3% of the respondents did not.

Question 5: Do you feel that 'C' programming language is ruling the software world till date?



The above pie chart displays the result of the survey for the fifth question which states that 79.9% of the respondents felt that C programming language is ruling the world till date while 14.3% of the respondents could not conclude that while 5.8% of the respondents did not feel that.

4. Conclusion

C language is simple, elegant and wicked fast; it's compact and efficient. Because C has raw pointers²⁵, bitwise operators²⁶, and the keywords: extern²⁷, volatile²⁸, static²⁹, and register³⁰, makes it focus more about writing efficient code than one can glean from any higher-level language. C continues to empower the world.

Many latest programming languages have borrowed directly or indirectly from C, such as: C++, C#, Unix's C shell, D, Go, Java, JavaScript, Julia, Limbo, LPC, Objective C, Perl, PHP, Ruby, Rust, Swift, Verilog, System Verilog, Python, etc. These languages have drawn many of their control structures and other basic features from C. Most of them express highly similar syntax to C, and they tend to combine the recognizable expression and statement syntax of C with underlying type systems, data models, and semantics that can be radically different.

The most commonly programmed language is the C language, due to the language's features such as: flexibility, efficiency, performance and closeness to the hardware.

C is the foundation of: Operating systems (Unix, Linux), Compilers (C compilers, FORTRAN compilers, Pascal), Run Time libraries (for C, C++, FORTRAN), Interpreters (Python, Ruby, Smalltalk, Java Virtual Machine), Databases (Oracle), Shells (C Shell, Born Shell, Koran Shell).

The world is running on C-powered devices. C is the past, the present, the future in many areas of software. Each and every programmer will start his/her programming journey with C as his/her first programming language because is the base for all the programming languages as it is called the mother language of all the programming languages. So, this is also one of the main reasons for the C Programming Language to rule the software world till date.

Hence, it can be concluded that C PROGRAMMING LANGUAGE – STILL RULING THE WORLD!

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Author Profile



Saphalya Peta was born and raised in the city of Hyderabad, in the state of Telangana, India. She is pursuing her second year of Bachelor of Engineering degree specialised in Computer Science in Chaitanya Bharathi Institute of Technology. Her father's name is Suresh Kumar Peta and mother's name is Saritha Devi Peta. Her hobbies are playing badminton; writing and working on research papers, articles; serving as a social worker and volunteer. Her places of interests to work are Artificial Intelligence, Data Science.