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INSTITUTE OF ENGINEERING & MANAGEMENT

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TECHNICAL REPORT

ON

Top Programming Languages of 2021

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ON

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CERTIFICATE OF APPROVAL

It is Certified that the report entitled Top Programming Languages of 2021: A Systematic Literature has been successfully completed by Jay Prakash Pandey under the guidance of Prof. Shreyasi Datta in recognition to the partial fulfilment for the award of the degree of Batchelor of Engineering in Information Technology, Institute of Engineering and Management, Kolkata.

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Acknowledgment

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Abstract

To get a job:

learn Python, Java or C# - those languages feature top of the "number of job vacancies listed" consistently and have done for years (I'm leaving javascript out of that list for reasons I'll mention in a moment).

Do you want to get a job in a particular field, say data science:

learn a language that's key to that field - data scientists use Python or R, or Scala maybe if they are using Spark, they don't tend to use Swift or PHP. But if you want a job in web development, then it's Javascript or Ruby or PHP etc etc.

If you want a high paying job and you're already an established Developer ?

Then maybe look at Go or Kotlin - there are far fewer jobs advertised, but also far fewer developers with those skills so developers are in high demand and can get better salaries.

Javascript often tops off a lot of lists, but that is because it is used as an adjunct to lots of other technologies - in particular web development. It's not so much used as a standalone language.

It would be a mistake to just learn javcascript because in the web development world, javascript knowledge alone is pretty useless without knowledge of the tech that it works with - CSS, HTML, Angular, Express, React etc... all the millions of different frameworks in web dev client and server side.

Keywords:

Hyper Text Markup Text(html), Cascading Style Sheets(css), Hypertext Preprocessor(php), Technology(tech), Developer(Dev), Coding, Application(App), Programming, Technology Trends

1.Introduction

Technology has a dramatic impact on our lives. As most individuals started to efficiently program computers, programming languages became more potent with luxurious features and high functionality.

Programming languages are used to instruct the computer in a language that the computer understands.

It’s a set of commands and instructions that empowers humans to instruct and control machines efficiently. It can help you create a software program integrating rich features via keeping up with the recent trends.

Mainly, programming languages are categorized into two categories one is a high-level programming language, and the other is low-level language.

High-level programming languages are designed to be easy to read and understand. It enables developers to write source code in logical words or symbols. The best example of the high-level programming language is Java, C++, PHP, and a lot more.

A low-level programming language provides developers with a minimal amount of abstraction at the smallest possible cost to perform and offer efficiency. A program written using low-level programming language can be made to run very quickly with a small memory footprint. The best example of the low-level programming language is assembly language.

So far, thousands of different top programming languages have created. You must be wondering which is the best programming language in 2021? Most of the programming languages consist of instructions for computers to implement algorithms. With several programming languages available, selecting the one can be a daunting task. Furthermore, it has become essential to possess programming knowledge for individuals to get desired placement worldwide.

As per the Stackoverflow, there are 67% of programmers who like to write code in Go language and the other 15% want to try it after Python and

JavaScript. Google also declared to work with the Go language, hence we can say the future is with the Go language due to its most attractive feature ‘simplicity’.

Even after having so much popularity, Go lang is not in so much demand of developers as per shown in this graph released by Github. According to Octoverse 2019, this language was not among the top 10 programming languages of the last decade but now, it has 10th place in the list of fastest growing languages.

2. Description/Methodology

Let’s know more about the most in-demand programming languages among developers worldwide as of 2021.

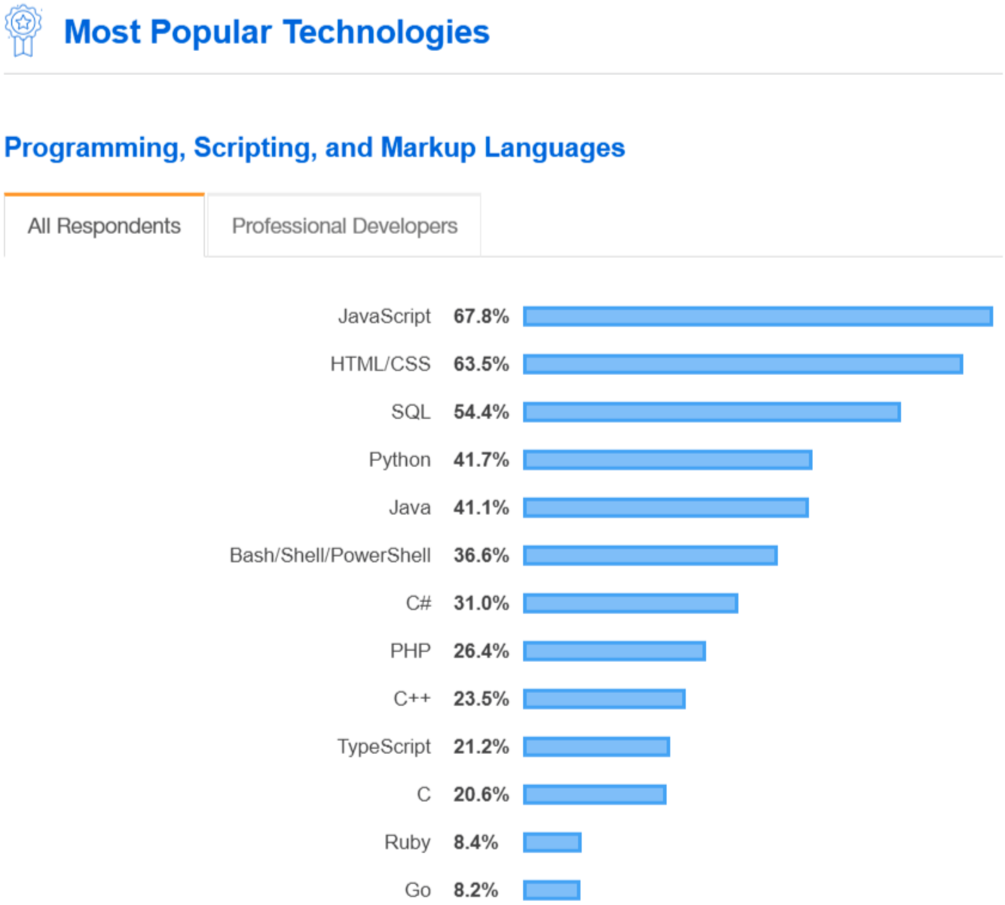

Fig. no. 2.1

Here are 10 of the most popular programming languages of 2020 based on the number of job postings listed on job search site Indeed, the average annual salary for those jobs, and factors such as ease of use and potential for growth.

2.1 Levels of Programming

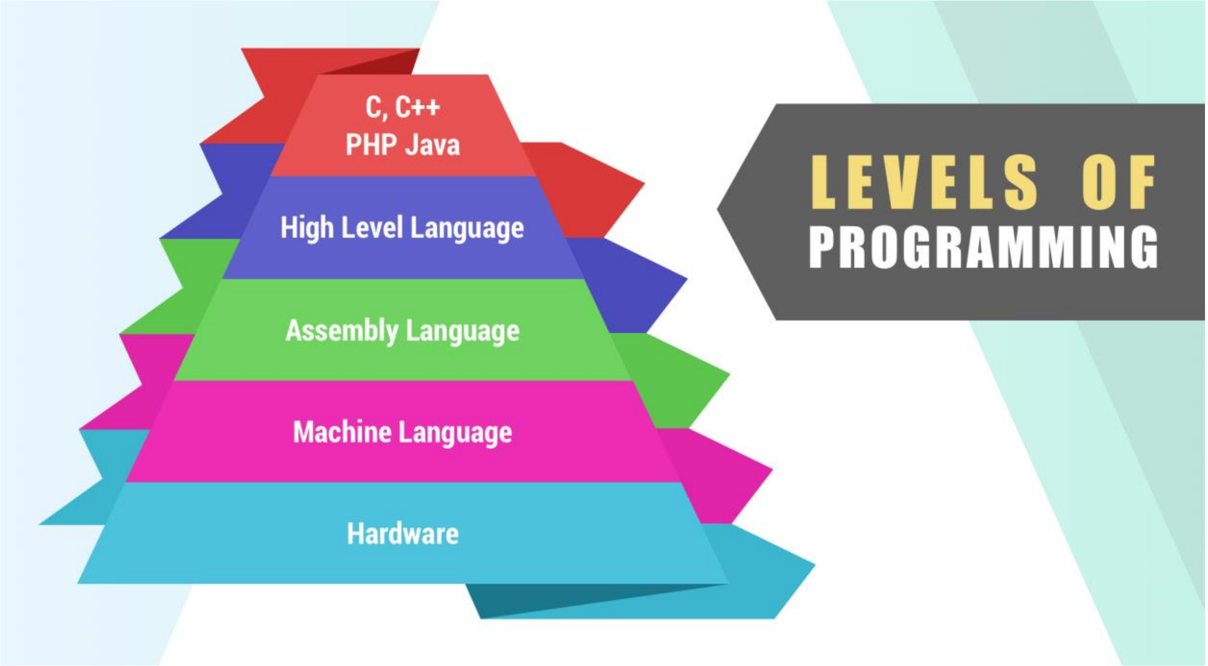

Fig. no. 2.2

There exist several programming languages with their own specific purpose and contains a unique set of keywords and syntax that are used to create instructions. The programming language varies in the level of abstraction and classified into two categories:

1. Low-level language
2. High-level language

2.1.a Low-Level Language

Parameters	**Machine Level Language**	**Assembly Level Language**
Hierarchy Level	It is at the lowest level in the hierarchy and has zero abstraction level from the hardware.	It is above the machine level language in the hierarchy and so has less abstraction level from the hardware.
Learning Curve	It is hard to understand by Humans.	It is easy to learn and maintain.
Written as	It is written in binary that is 0 or 1.	It is written in simple English and is easy to understand.
Generation	It is a first-generation programming language.	It is the second-generation programming language.
Requirement for Translator/Assembler	The machine code is executed directly so no translator is required.	It requires an assembler to convert assembly language to machine code.

Table no. 2.1.a

Low-level languages provide abstraction from the hardware and are represented in the binary form i.e. 0 or 1 which are the machine instructions. Low-level languages are further classified as machine-level language & assembly level language.

2.1.b High-Level Language

High-level language allows us to write programs that are independent of the type of computer. The high-level languages are named as high-level because they are close to human languages and can be understood easily, however it requires attention to the logic of the problem. The language needs a compiler to translate a high-level language into a low-level language. Further, the high-level languages provide the following advantage.

1. The high-level language is easy to learn & maintain.
2. The high-level languages are portable i.e. they are machine-independent.

Parameters	**Low-Level Language**	**High-Level Language**
Level of Understanding	It is machine friendly i.e. easily understood by computers.	It is user friendly, as it is written in simple English.
Time of Execution	Takes time to execute.	Executes at a faster pace.
Tool Required	It requires the assembler to convert assembly code to machine code.	It requires the compiler to convert the high-level language to machine instructions.
Portability	It is not portable.	It is portable.
Memory Efficiency	It is memory efficient.	It is less memory efficient.
Debugging and Maintenance	Not easy	Easy

Table no. 2.1.b

3.Types of Programming

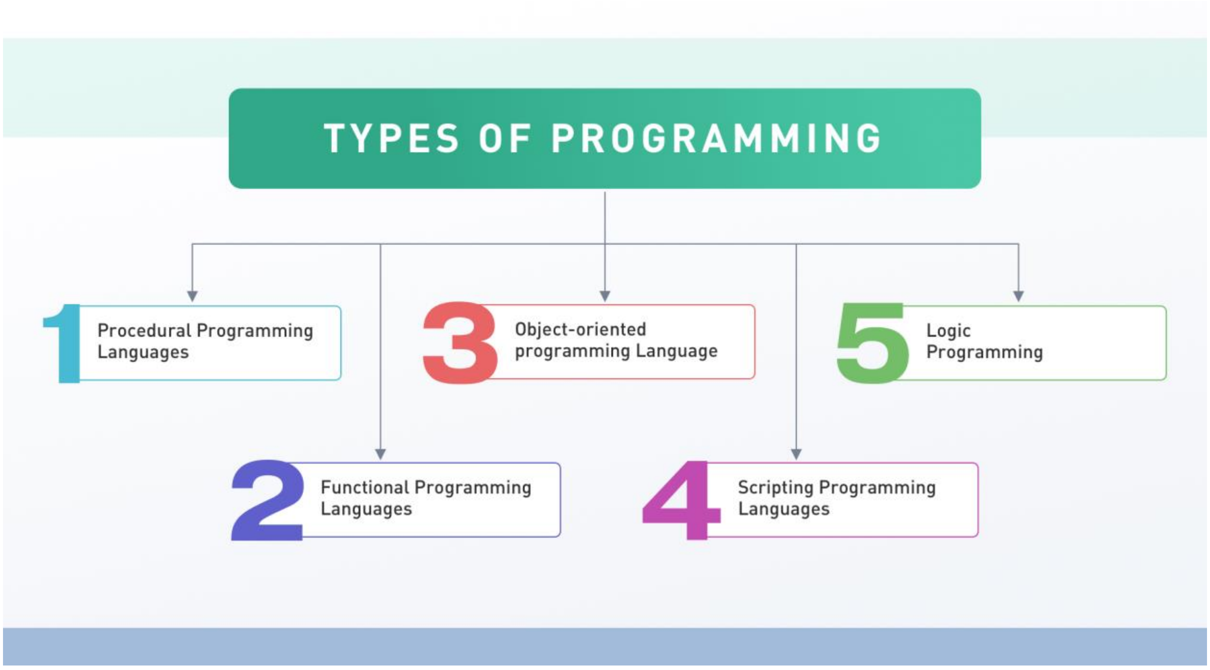
TYPES OF PROGRAMMING
1 Procedural Programming Languages
2 Functional Programming Languages
3 Object-oriented programming Language
4 Scripting Programming Languages
5 Logic Programming

Fig. no. 3.1

Let us now take an overview of different types of programming languages:

3.1. Procedural Programming Languages

This programming paradigm, derived from structured programming specifies a series of well-structured procedures and steps to compose a program.

It provides a set of commands by segregating the program into variables, functions, statements & conditional operators. Various Programming editors or IDEs help users develop programming code using one or more programming languages. Some of them are Adobe Dreamweaver, Eclipse or Microsoft visual studio, BASIC, C, Java, PASCAL, FORTRAN are examples of Procedural Programming Language.

3.2. Functional Programming Languages

A functional programming language is a declarative programming paradigm where programs are constructed by applying and composing functions. The language emphasizes expressions and declarations than on the execution of statements. The foundation of functional programming is lambda calculus which uses conditional expressions and recursion to perform the calculations.

It does not support iteration like loop statements & conditional statements like if-else. Some of the most prominent functional programming languages are Haskell, SML, Scala, F#, ML, Scheme, and More.

3.3 Object-oriented programming Language

This programming paradigm is based on the “objects” i.e. it contains data in the form of fields and the code in the form of procedures. OOPs, offer many features like abstraction, encapsulation, polymorphism, inheritance, classes, and Objects. Encapsulation is the main principle as it ensures secure code.

It also emphasizes code reusability with the concept of inheritance and polymorphism allows the spreading of current implementations without changing much of the code. Most multi-paradigm languages are OOPs languages such as Java, C++, C#, Python, Javascript, and more.

You can read more in detail about OOPs Concept here.

3.4. Scripting Programming Languages

All scripting languages are programming languages that do not require a compilation step and are rather interpreted. The instructions are written for a run time environment. The languages are majorly used in web applications, System administration, games applications, and multimedia.

It is used to create plugins and extensions for existing applications. Some of the popular scripting languages are:

- Server Side Scripting Languages: Javascript, PHP, and PERL.
- Client-Side Scripting Languages: Javascript, AJAX, Jquery
- System Administration: Shell, PERL, Python
- Linux Interface: BASH
- Web Development: Ruby

3.5. Logic Programming

The programming paradigm is largely based on formal logic. The language does not tell the machine how to do something but employs restrictions on what it must consider doing. PROLOG, ASAP(Answer Set programming), and Datalog are major logic programming languages, rules are written in the form of classes.

Let us take a look at the best Programming Languages to learn in 2021 for a job and for future prospects:

4. TOP PROGRAMMING LANGUAGES

4.1 Python

Number of jobs: 19,000

Average annual salary: $120,000

Python undoubtedly tops the list. It is widely accepted as the best programming language to learn first. Python is a fast, easy-to-use, and easy-to-deploy programming language that is being widely used to develop scalable web applications.

YouTube, Instagram, Pinterest, SurveyMonkey are all built-in Python. Python provides excellent library support and has a large developer community.

The programming language provides a great starting point for beginners. Talking about those who are looking for a better job, you should definitely learn Python ASAP! A lot of startups are using Python as their primary backend stack and so, this opens up a huge opportunity for full-stack Python developers.

Python is considered as a gold mine of capabilities enabling developers to develop virtual reality-based app offering ultimate user experience. This versatile language is used to develop a variety of applications.

It offers a seamless experience and is provided with endless possibilities to create the next big thing using trending technologies like artificial intelligence and machine learning.

4.1.1 Python Framework

1. Djang
2. Flask
3. Falcon
4. Growler
5. Pycnic
6. Giotto
7. Hug
8. Pyramid
9. Tornado
10. Sanic

4.1.2Advantage

- Extensive library support
- Object-oriented language
- High-level language
- User-friendly data structures
- Platform Independency
- Presence of third-party modules
- Open-source with the ever-growing popularity
- Easy to learn
- Offer the ability to develop a complex application
- User-friendly data structures
- Focuses on the code readability
- Databases Connectivity

Disadvantage

- Limitation of Speed
- For Mobile Development g
- Python Memory Consumption is high.
- Run time error
- Problems with Threading
- Limitation of DataBase Access

Application

- Operating System Development
- Web Framework and Web Application Development
- Enterprise and business applications
- For Prototyping
- Graphical User Interface Desktop Application Development
- For Game Development
- Data Analysis
- Image processing
- Scientific Applications

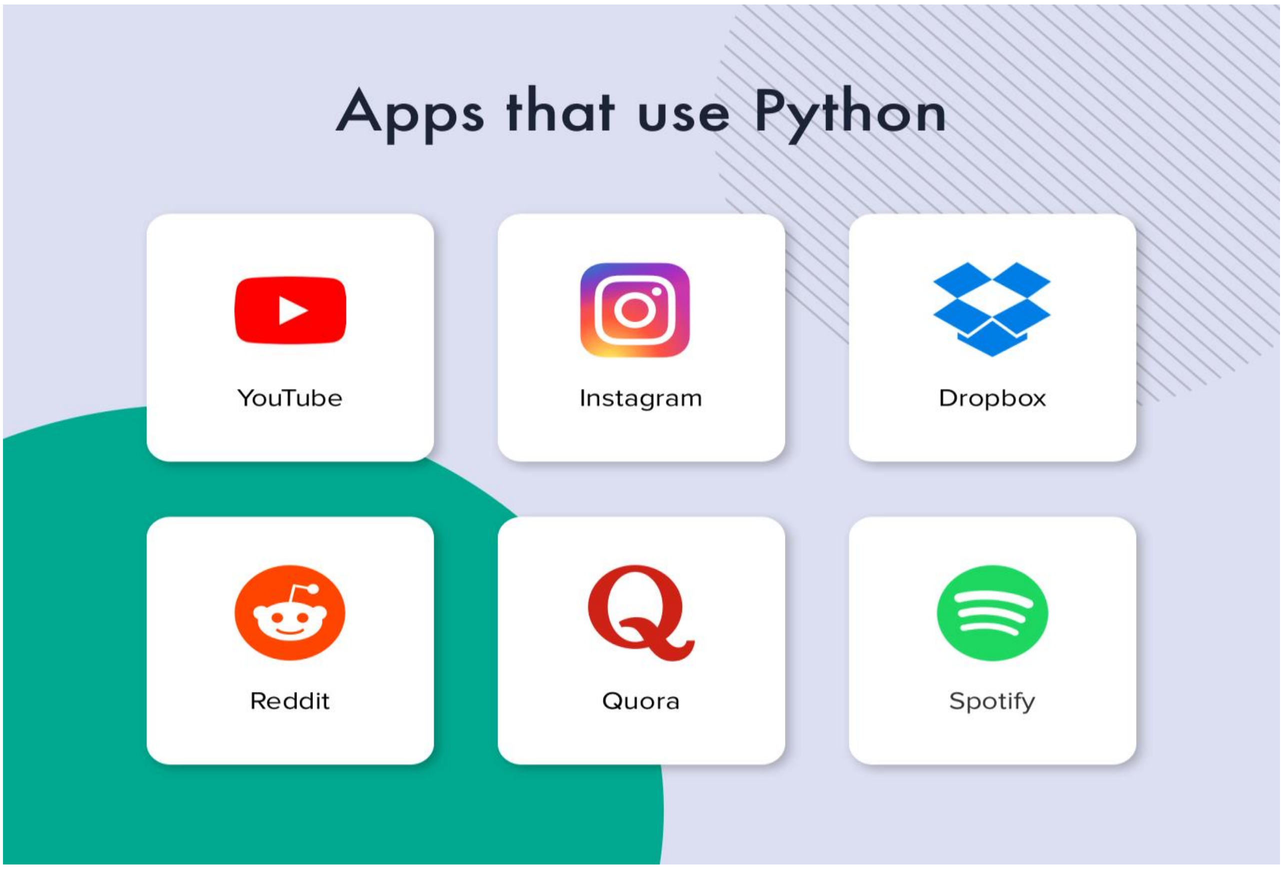

Fig. no 4.1

4.2 JavaScript

Number of jobs: 24,000

Average annual salary: $118,000

Javascript is a dynamic language that first appeared in December 1995. It’s a prototype-based, multi-paradigm, powerful language. Javascript supports object-oriented, imperative, and declarative style by being the language of the web.

It improves the possibility of data validation, ensuring no vulnerabilities. Javascript used for both server-side and client-side programming. Regular updates of this language keep you updated and help you meet market expectations.

This widely-used programming language is easy to use and enables developers to create a high-level application in this language. It works well for the WEBVR platform involved in the production of web-based applications.

4.2.1 Advantage

- Easy to learn
- Client-Side Scripting Language
- It extended the functionality of web page
- No Compilation is needed
- Easy to debug and testing
- Cross-platform
- Speed is fast
- Rich Interface
- Versatility
- Rich Library

4.2.2 Disadvantage

- Code is always visible
- Client-side security
- Rendering Issues
- Not Support all Web Browser
- Single Inheritance
- Sluggish bit-wise function

4.2.3 Application

- Web Application Development
- Web Server Application Development
- Game Development using HTML5
- Mobile App Development
- Smart Watch Application

4.2.4 Framework

- Angular
- React
- Node Js
- Aurelia
- Mithril
- Backbone.js
- Meteor
- Vue.js

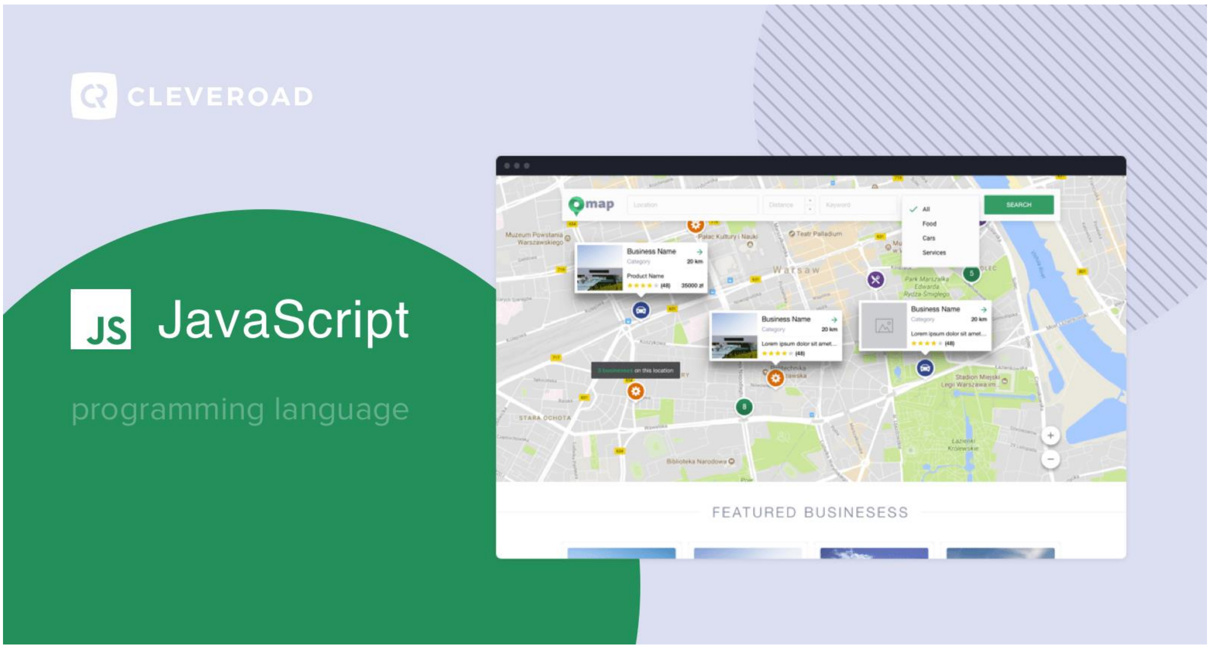

Fig. no. 4.2

4.3. Java

Being in the industry for years, it captures the developer's attention. It first appeared in 1995, with flexible options to run any browser window.

Java is a general-purpose computer network programming language that is simultaneous, class-based, object-oriented, and specially designed to have as few dependencies as possible on execution. It is designed to allow application creators to "write once, run anywhere" (WORA), which means that compiled Java code can run on all Java-supporting systems without recompiling.

A recent survey conducted by the TIOBE index stated, Java has become a top programming language.

It can adapt to a dynamic environment that promotes dynamic allocation of memory by reducing memory waste and increasing application performance. By using a bytecode, which can be readily translated into native machine code, Java achieves exceptionally high efficiency.

4.3.1 Advantage

- Java supports Multithreading
- Automatic Memory Management
- Stability and massive community
- Remote Method Invocation(RMI)
- The security risk is low
- Good for enterprise computing
- High-Level Language

4.3.2 Disadvantage

- Poor Performance in Speed
- Garbage collection
- Paid for the commercial license
- Poor Memory Management
- Not Support unsigned Data Type

4.3.3 Application

- Embedded Systems
- Web Applications
- Development of Web Servers and Application Servers
- Development of Enterprise Applications
- Build Desktop GUI Applications by using AWT and Swing
- Development of Game Engine
- Development of Cloud Application
- Development of Distributed Application

4.3.4 Framework

- Hibernate
- Spring
- Google web toolkit [GWT]
- Struts
- JavaServer Faces [JSF]
- Vaadin
- Play
- Dropwizard
- Blade
- GRAILS

To enjoy our partners on the platform we need you to answer a few question before you get started.

Note: Filters only apply to partner gyms

Fig. no. 4.3

4.4 C++

Bjarne Stroustrup developed C++ as an addition of the C language with important, generic programming features.

C++ is one of the influential object-oriented, general-purpose programming languages. It plays a crucial role in developing an advanced game app offering lucrative gameplay.

In this progressive era, C++ language can be used in developing virtual reality on the Unreal Engine 4 platform. It allows developers to create an augmented reality, virtual reality concept without writing the code. For additional features and functionality, developers may require to write the code.

You can easily find a C++ developer with an extraordinary skill set to develop and create great outstanding concepts and games using trending technologies.

4.4.1Advantage

- C++ support rich function library
- C++ support Multi-paradigm
- C++ is an Object-Oriented Programming Language

- Low-level Manipulation
- Memory Management
- Scalability
- Large Community Support
- Support Cross-Platform
- The speed of execution is fast.

4.4.2 Disadvantage

- Security is low
- Not Support Garbage Collector
- Not support Built-in Thread
- C++ use Use of Pointers

4.4.3 Application

- Development of Operating System
- Development of Game
- Development of Web Browser
- Compiler Development
- Development of Graphics
- Banking Application
- Development of Database Software

4.5. PHP

Php is the most widely used language/platform for web-based apps and website creation today. It is also known as Hypertext preprocessors created by Rasmus Lerdorf in 1994.

It enables developers to create an interactive dynamic web page that effectively works with the database. It is also considered as a general-purpose programming language that can be easily embedded in HTML files and HTML codes. If you wish to get server-side web development, then this is the language you wish to choose.

4.5.1 Advantage

- PHP is Open Source language
- PHP is platform-independent
- Large community support
- Offers numerous automation tools
- Supports object-oriented and functional programming
- Easy to learn and execute
- Easy to maintain
- It is stable

4.5.2 Disadvantage

- It does not fully secure because it is an open-source language

- It is not suitable for large application
- Poor Error handling
- It does not support a large no of app

4.5.3 Application

- Web Application Development
- Development of CMS
- eCommerce Web Application
- Image Processing and Graphics Design
- To Development of Data Representation System

4.5.4 Framework

- Laravel
- Yii2
- CodeIgniter
- Cake PHP
- Fuel PHP
- Slim
- Zend

Projects developed with PHP
Wikipedia
Yahoo
WordPress
MailChimp
Flickr

4.6. Swift

Swift is the programming language that is used to develop iOS applications. iOS-based devices are becoming increasingly popular.

Apple iPhone, for instance, has captured a significant market share and is giving a tough competition to Android. Therefore, those who want to serve this community can learn Swift programming.

***Difficulty level*:** Easy to moderate to learn. 3.5 out of 5.

Job opportunity: Huge! 4 out of 5.

4.6.1 Pros

- Automatic memory management prevents memory leaks
- Backed by Apple
- Better scalability allows easily adding functionalities to the product and/or bringing in additional developers
- Easy to add new features
- Encourages developers to write clean and readable code
- English-like syntax makes it highly readable
- Interoperable with Objective-C
- It is possible to integrate Server-side Swift with any technology
- Makes code sharing better and development process faster when used for both frontend and backend development
- Very fast as compared to other popular programming languages, such as Objective-C and Python

4.6.2 Cons

- Limited community support and resources
- Somewhat unstable due to being a relatively new arrival on the programming scene
- No support for legacy projects; can be used only for iOS7 or later apps

4.7. R

R, along with Python, is one of the best programming languages in 2021 for data analysts and data scientists. It's a language to do statistics.
R works for adhoc analysis and exploring datasets, for statistics-heavy projects, and one-time dives into a dataset.

R language is used for to run R programs and get results (graphics or text) within Mediawiki, the software behind Wikipedia.

R is a popular programming language developed by Ross Ihaka and Rober Gentleman in 1993. It's mainly popular among data miners and statisticians for developing advanced statistical software and data analysis.

This programming language includes machine learning algorithms and allows individuals to analyze data following certain steps:

Programming > Transforming > Discovering > Modeling > Communication

R is specially designed for data science and to do statistics. Due to its lucrative features and high functionality, multiple industries use it.

4.7.1 R programming highlights

- acts as an interactive statistical environment
- used for statistical inference, data analysis, ML algorithms
- runs on Windows, Mac OS X, Linux

4.7.2 Advantage

- It is Open Source language
- It is Cross-platform
- It is a support extension
- Support for data wrangling
- Connect with other languages
- Engaged community
- It supports Array of Package
- Quality plotting and graphing

4.7.3 Disadvantage

- Execution Speed is not good
- Issues in Data handling
- It provides basic security
- Complicated Language

4.7.4 Framework

- Shiny

4.7.5 Application

- Data Analysis
- Data Representations
- statistical analysis
- Finance
- Backing Application
- Scientific Data Analysis

5. How to Get Started? (Disscussion)

Although there are hundreds of programming languages, very few are on the shortlisted languages you should know, and the seven described above the top that list, in our opinion, as a training provider.

If you want to start a career as a programmer, make a lateral move into another field, or advance up the ladder at your current job, learning one of these languages is an excellent place to begin your transition. And since courses range from Python for the beginner to Java for the experienced, you can find the right fit for you.

Once you've decided it's time to learn a new language, turn to Simplilearn for both training and certification. We offer courses in all seven of these languages (Java, Javascript, C, C#, Python, Swift, and Ruby), plus others, all with content developed by industry leaders, an emphasis on hands-on learning, and 24x7 support. You'll learn the language, plus get the credibility of certification. And then you can land one of those high-paying programmer jobs!

6. Summary/ Conclusion

- Python and JavaScript are hot in the startup world. Many startups use Django (Python), Flask (Python), and NodeJS (JavaScript) as their backend frameworks. Python and JavaScript are easy-to-learn and therefore considered the best programming languages to learn for beginners. Moreover, both of them also provide a huge market opportunity. Therefore, those who are looking for a job change may also consider learning them.

- Java and PHP are hot in the corporate world. Many organizations use Spring (Java) and Codeigniter (PHP) as their web backend framework.
- R and MATLAB are hot in the Data Analytics world. If you wish to develop a career in Data Analytics or Data Science, these are the languages to learn.
- C/C++ and Golang are the top choices in building low-latency and scalable systems.

7. Everything Considered

Comparing programming languages is a daunting task. Figuring out what is best for you only depends on your requirements and the futuristic approach you wish to follow in 2021. The languages which are fighting for its acceptance this year can be seen in trending programming languages 2021.

All the languages are essential to developing a next-generation app considering the rapid growth of the industry. These are some of the hottest future programming languages 2021 in any industry helping people to undergo a redefining experience.

Finally, the number of HCL (human-readable language for DevOps) contributions is growing too, up to 213%.

8. Recommendation

What Programming Language Suits Your Project ?
Let’s face it: sometimes it’s easy to get lost in all these current and future programming trends.

But it’s the choice of the right tech stack that stands for your product’s maintainability and scalability. That’s why you should know what tool you’re picking and why.

At Cleveroad, we have a skilled team of business analysis that deal with technology stack selection for our clients’ projects.
BA team studies the projects’ requirements, it's complexity, and then picks the best-fitting tools for software development.

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