Suitability Evaluation of Programming Languages

Azhar Khan[1], Sandeep Tuli[2], Dr. Megha Gupta[3]

[1-2]UG Scholar, [3]Associate Professor, Department of CSE, Poornima Institute of Engineering & Technology, Jaipur, India

Abstract: This paper lays down various parameters to decide which programming language suits for a particular need like installation on a machine, learning for a novice, speed, data type handling, suitability for open source projects, concurrency support, data structure based performance and support and various other related terms in order to reduce the number of choices available for a developer and provide with the most suitable choice.

Keywords: Programming Languages; Suitability Evaluation; C; C++; Java; Python.

I. INTRODUCTION

As the world is moving ahead, each week a new programming language is introduced which leaves the developer with so many choices due which it becomes hard for the developer to choose one for a particular purpose. If we go alphabetically, we will find at least 20 programming languages from each alphabet. Thus study needed to be done to judge and figure out the most suitable languages for a particular purpose based on certain parameters. Despite of so many choices available, some programming languages remain as the common interest of programmers like C, C++, Java, Python, Php, GO, SCALA and many more. Each of these languages has their own strengths and disadvantages will be laid down in this paper.

II. PROBLEM STATEMENTS

A. Which language is easy for instalation on a system?

With so many operating systems available, some programming languages are available for all OS's but some are available only for particular OS. Some are pre-installed where as some are not.

B. Which language is easy to learn for a novice?

[1] Some languages are very easy to pickup and learn for a novice but some are equipped with so many features and concepts, which can't be grasped by a novice.

C. Which language has better support for data types/ data structures(with respect to speed and ease of implementation)?

[3] Some languages have easy to implement data structures but are slow in speed where as some are faster but has very complex way of implementation.

D. Which language provides better job options?

[4] Programming languages play an important role in finding a job. Some languages have job boom but at the same

time number of people ready with those skills is also large in number.

E. Which language is most suitable for open source projects?

[2] Open source projects tend to run for years in which there are many chances that the language used might die or loose popularity. Thus the language chosen for a open source projects should be expected to be in trend for time project runs or the code written should be portable to other language.

III. METHODS

Various methods are implemented for various problem statements mentioned before.

- Various installation packages were compared for their size and ease of installation. Also commonly used operating systems were compared to see weather they comes with a language preinstalled or not.

- A questionnaire was prepared and was distributed among students who know all four languages C, C++, Java and Python to figure out their views and experience in programming languages.

- A common array and loops program was implemented in different languages and their results were compared to see speed and support in a particular language.

- A Job seekers and Job posting for certain languages will be studied for past few years.

- To decide support for open source projects, data released from big players in open source development like apache and Ubuntu are studied.

IV. DETAILED CONTENT

A study and analysis was done on the collected data from various sources in order to get answer for the stated problem statements. Thus some answers and conclusions were made which are discussed below.

A. Installation of Programming Languages:

As said before some languages come pre-installed on various systems where as some are need to be installed. Like C language comes pre-installed on almost all Unix like operating system. Similarly python comes preinstalled on various Unix variant like on Ubuntu, MacOS (OS X). Also windows operating system comes preinstalled with VBScript and other Microsoft created languages.

But there are some languages, which are need to be installed, like Java and come in a large package. In terms preinstalled language MacOS (OS X) takes a lead to other operating systems because it comes preinstalled with C, C++, Python, Ruby, Php and many more.

Table 1. Languages Preinstalled on OS or not

OS	C	C++	Java	Python	Ruby	Php
Linux (Ubuntu)	☐	☐	☐	☐	☐	☐
Windows	☐	☐	☐	☐	☐	☐
MacOS (OS X)	☐	☐	☐	☐	☐	☐

If we compare the languages based on their installation package size then [7] C and [11] C++ compiler comes in smallest size packages. For comparisons we have taken into consideration amd64 operating system with latest version of language except for php in which version 5.6 is considered. Although for MacOS (OS X) the C and C++ compilers are installed by installing command line tools which is large in size also includes many other tools like Apache Server, php, Unix command support, Ruby and many more. Setup of java comes in largest size as compared to other languages.

Table 2. Size of Installation Package

OS	C (GCC)	[10] C++ (G++)	[9] Java	[8] Python 3.x	[7] Ruby	Php
Linux (Ubuntu)	7,394.7 kB	17,709.5 kB	70.26 mB	14.4 mB	6982 kB	129 mB (Xampp)
Windows	24.3 kB	275 kB (Cygwin)	195.51 mB	29.9 mB	18 mB	109 mB (Xampp)
MacOS (OS X)	~150 mB using Command Line tools		62.68 mB	26.2 mB	Included in Command Line Tools	

B. Learning for Novices:

The most commonly preferred languages for novices include C, C++ and Java. Although outside Asia Python also competes in this race but is not much famous in Asia specific regions. Thus to find out which language is most suitable for learning for a novice, we created a questionnaire and distributed that questionnaire among the students who knew all of the four languages namely C, C++, Python and Java. The results obtained were as follows:
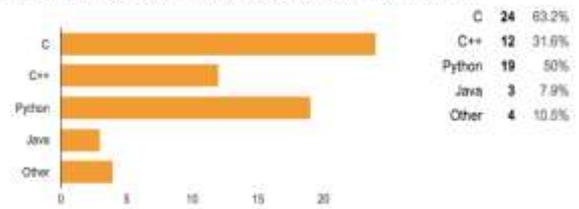

Fig. 1. Which language(s) according to students is most easy to learn for a novice?

Most of the students think C is the most easy to learn language for a novice (63.2%) followed by Python (50%).
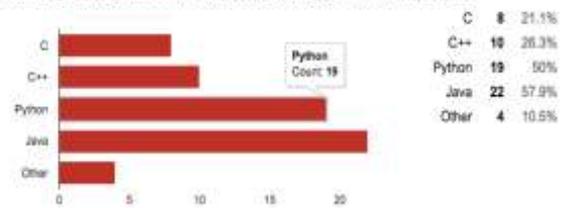

Fig. 2. Which language(s) has better support for data types?

57.9% students say that Java has the better support for data types and Python provides toughest competition to it i.e. 50% because of its easy to use and dynamic type casting.
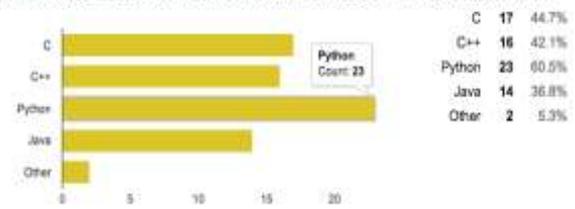

Fig. 3. In which language(s) conditional statements and loops are easy to implement?

According to 60.5% students, Python has the simplest implementation of loops and conditional statements followed by C and C++ with 44.7% and 42.1% respectively.
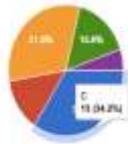

Fig. 4. Which language requires least time to learn?

A majority of students think that Python language requires least time for learning i.e. 60.5%. No other language gives competition to it.

Fig. 5. Which language will you suggest for a novice?

34.2% students say that they will suggest C language to novices whereas 31.6% also suggests Python as the first programming language for Learning.

C. Speed of programming languages

To compare the execution speed of languages, we declaring an array or similar data structure in every language, then assigning values to it and then printing it. We are using "time" command to measure the execution time of each language.

NAME

 time -- time command execution

SYNOPSIS

 time [-lp] utility

V. DESCRIPTION

The time utility executes and times utility. After the utility finishes, time writes the total time elapsed, the time consumed by system overhead, the time used to execute utility to the standard error stream. Times are reported in seconds.

```c
#include<stdio.h>
int main(){
    int l[1000],i;
    for(i=0;i<1000;i++)
        l[i]=i;
    for(i=0;i<1000;i++)
        printf("%d\n",l[i]);
    return 0;
}
```

Fig. 6. Sample test code for C language

```cpp
#include<iostream>
using namespace std;
int main(){
    int l[1000],i;
    for(i=0;i<1000;i++)
        l[i]=i;
    for(i=0;i<1000;i++)
        cout<<l[i]<<endl;
    return 0;
}
```

Fig. 7. Sample test code for C++ language

```python
l=list(range(1000))
for i in range(len(l)):
    print(i)
```

Fig. 8. Sample test code for Python language

```java
public class Speed {
    public static void main(String[] args) {
        int [] l = new int[1000];
        for (int i = 0; i < l.length; i++) {
            l[i]=i;
        }
        for (int i = 0; i < l.length; i++) {
            System.out.println(l[i]);
        }
    }
}
```

Fig. 9. Sample test code for Java language

```ruby
l=Array.new
for i in 0..1000
    l.push(i)
end
for i in 0..1000
    puts(l[i])
end
```

Fig. 10. Sample test code for Ruby language

```php
<?php
$l=array();
for($i=0;$i<1000;$i++)
    array_push($l,$i);
for($i=0;$i<1000;$i++)
    echo($l[$i]."\n") ;
?>
```

Fig. 11. Sample test code for Php language

Table 3. Execution Time Comparison

Language	C	C++	Java	Python	Ruby	Php
Execution Time	.013s	.018s	.154s	0.067s	.046s	.091s

Results can be drawn from above table that C language is fastest among all and it's biggest competitor is C++. Ruby and Php are considerably faster than Python and Java is slowest among all of these. The reason for Python being is slow is it's dynamic nature and Java is slow because of byte code conversion process.

Fig. 12. Graphical representation of execution time taken.

A. Jobs Point of View:

Jobs have been the top most priority developers while learning a language. Although some might disagree on this point because according to them it not about the language, it's about the concept. But still in market some language have higher job trends as compared to others. For this we collected data from [4] indeed.com about previous and current job trends.
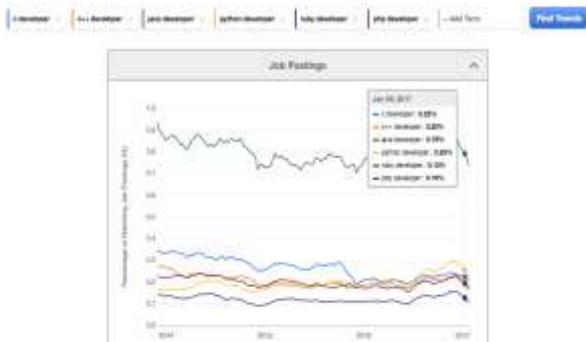

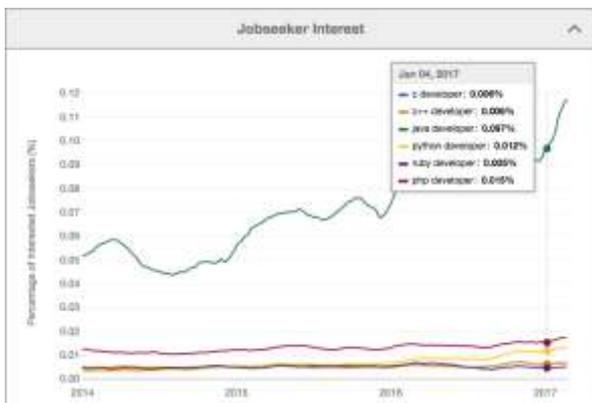Fig. 13. Job postings in C,C++, Java, Python, Ruby, Php

Fig. 14. Job seekers in C, C++, Java, Python, Ruby, Php.

B. Support For Open Source Projetcs:

The biggest fear for open source project is that the language in which are being written might die with time

due to which the developers might have to rewrite the whole project or migrate the code in another language if the language in which the project was written supports portability. [5] For this we collect the data from big giants in the game of open source projects like apache, Ubuntu.

Open Source Project	L1	L2	L3	L4	L5
Apache	Java	shell	perl	javascript	Ruby
Mozilla	javscript	css	shell	Python	Html
Ubuntu	shell	python	Ruby	C	c++
Open Source Project	L6	L7	L8	L9	L10
Apache	Python	C	Php	Scala	puppet
Mozilla	ruby	Php	c++	Java	C
Ubuntu	Puppet	javscript	Viml	Php	Java

Fig. 15. Programming Languages accepted by Mozilla, Apache and Ubuntu

Progamming Language	Forked with more than 50 times			Forked with less than 50 times		
	Apache	Mozilla Firefox	Ubuntu	Apache	Mozilla Firefox	Ubuntu
java	119	0	0	4,400	84	154
shell	5	2	39	1230	269	4506
perl	0	0	0	910	0	0
javascript	34	27	3	836	5166	302
ruby	15	0	3	763	96	974
python	15	1	5	732	256	1038
c	6	2	0	646	53	532
php	6	0	0	626	93	211
scala	13	0	0	368	0	0
puppet	3	0	3	129	0	303
css	0	2	0	0	606	0
html	0	2	0	0	0	0
c++	0	1	0	0	91	323
viml	0	0	1	0	0	278

Fig. 16. Which language can increase Mozilla, Apache and Ubuntu survivability?

Thus from the above table we can say that If one goes for languages among Shell, Python, Ruby, Java, C then most probably the project will not suffer survivability issue in the future. Also most of †he languages among them are portable.

VI. CONCLUSION

For a smart city a smart technology is required. And smart technologies are created with a choice of smart programming language. Well it is hard to tell an all rounder player in pool of programming languages still we have seen certain commonly used languages. If we consider pre-installed languages then C and Python is on lead because they come pre-installed on most of the Operating Systems. If the size of installation package is considered then again C language wins because its compiler comes in smallest size. For novices, there is a tie between C and Python, thus they should choose one among these two. If the speed is considered then no one can beat C. C++ is also a strong competitor in this case

but Java here is big loose string. For job scenarios, although maximum number of jobs is available in Java but number of job seekers are even more than that. Thus from job point of view one should avoid Java as a choice. For open source projects preferred languages are Java Script, Shell, C, Java, Python, Ruby and Php majorly.

VII. REFERENCES

[1] Chieh-An Lo, Yu-Tzu Lin and Cheng-Chih Wu , "Which programming language should students learn first?" 2015 International Conference on Learning and Teaching in Computing and Engineering, pp. 225-226

[2] Bee Bee Chua, University of technology, Sydney, Australia, "Detecting sustainable programming languages through forking on open source projects for survivability", pp 121 and 123.

[3] Miti S Bhat, Deepthi G Nair, Devyani Bansal and Vaishnavi J, "Data Structure based Performance Evaluation of Emerging Technologies -A Comparison of Scala, Ruby, Groovy, and Python,"

[4] https://www.indeed.com/jobtrends

[5] www.apachefriends.org

[6] rubyinstaller.org

[7] packages.ubuntu.com

[8] www.python.org

[9] www.oracle.com

[10] horstmann.com

[11] www.cplusplus.com