The Best Programming Language to Learn: A Data-Driven Approach

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Abstract

Choosing the most suitable programming language to learn is a critical decision for software engineers and developers, significantly impacting their career trajectory and job satisfaction. This paper offers a comprehensive, data-driven analysis to guide individuals in selecting the best programming language based on factors such as popularity, salary potential, and user satisfaction. Utilizing extensive data from sources like the StackOverflow Developer Survey and the JetBrains Developer Survey, the research provides an in-depth evaluation of languages, including Rust and JavaScript.

The study underscores Rust's growing popularity, particularly in the United States, where it is often linked with higher salaries and high satisfaction among developers. In contrast, while JavaScript remains a dominant language in web development due to its versatility, it generally offers lower average salaries and satisfaction rates. By exploring these dimensions, this paper equips both aspiring and experienced developers with the insights needed to make informed decisions about their programming language focus.

The analysis emphasizes the importance of staying updated on industry trends and the evolving landscape of programming languages. It offers valuable guidance for those aiming to enhance their skills and remain competitive in the dynamic field of computer science and software development.

Summary

Selecting the optimal programming language to learn and master is a crucial decision for aspiring software engineers and seasoned professionals alike. This paper aims to provide a data-driven approach to identify the best programming language in various categories of computer science and development. Utilizing comprehensive data from the StackOverflow Developer Surveys (2011-2023) and the JetBrains Developer Survey (2017-2023), we will analyze factors such as popularity, salary potential, and user satisfaction to guide you in making informed decisions about your programming language of choice. The key takeaway of this paper is the visible spike in Rust's popularity and its high desirability. (see Fig.1.a)

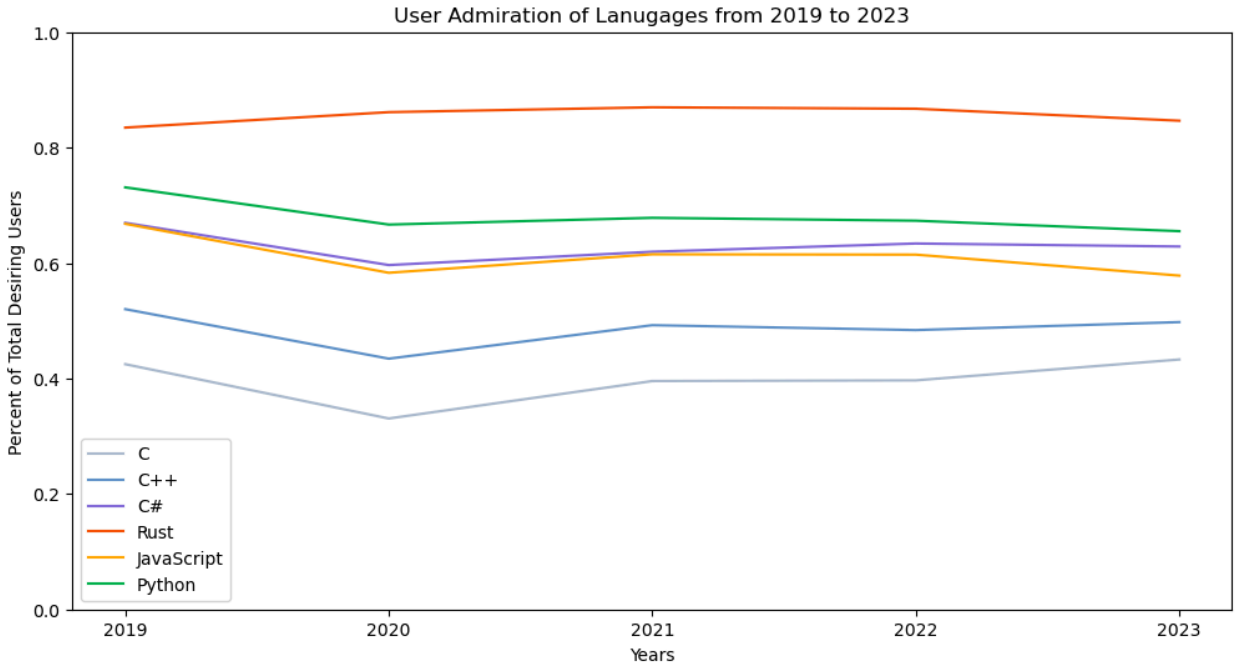


Fig.1.a: A line graph of the admiration of select languages from 2019 to 2023.

Introduction

Time is a finite resource, and making efficient decisions is vital in ensuring a productive and successful future. For software engineers, selecting the right programming language to learn can significantly impact their career trajectory.

Despite the abundance of articles on this topic, many lack empirical evidence and rely on heavily personalized opinions. This paper seeks to fill that gap by providing a thorough analysis of programming languages based on validated data.

As an amateur software engineer with a vested interest in making informed career decisions, I aim to determine the most suitable programming language to pursue. This decision is not only crucial for professional development but also for personal growth, as it can prevent the acquisition of a potentially useless skill.

Data

The primary data source for this paper is the StackOverflow Developer Survey.

StackOverflow Developer Survey

- Years Covered: 2011-2023
- Respondents (2023): 89,184
- Data Anonymization: Pseudonymization, replacing identifiers with random IDs
- Deduplication: Comparing the results from the same IP address,

retaining the most complete response

The secondary, and lightly used data source for this paper is the 2023 JetBrains Developer Survey.

JetBrains Developer Survey

- Years Covered: 2017-2023
- Respondents (2023): 26,348

Both surveys provide insights into various aspects of programming languages, including popularity, salary potential, and user satisfaction.

Results

Rust

Rust has experienced a notable increase in popularity and desirability in recent years. In the United States, Rust developers often earn higher salaries compared to those using other languages. Rust is praised for its rich ecosystem of tools and libraries, catering to a wide range of development needs. According to the official Rust website the primary reasons for developers leaving the language are often beyond their control, with issues such as missing tools, language features, or libraries accounting for less than 11% of the cases.

- User Satisfaction: 84.7% of Rust users enjoy working with the language (StackOverflow 2023).

JavaScript

JavaScript is one of the most widely used programming languages. However, it faces challenges such as lower admirability among developers and relatively lower average salaries. Despite its extensive use in web development, these drawbacks may influence its appeal to new learners.

Comparative Analysis

- Popularity: JavaScript leads in usage but trails in user satisfaction and salary potential. (see Fig.2.a)
- Desirability: Rust ranks higher in terms of desirability and user satisfaction. (see Fig.2.b)
- Salary: Rust developers in the United States earn higher average salaries. (see Fig.2.c)

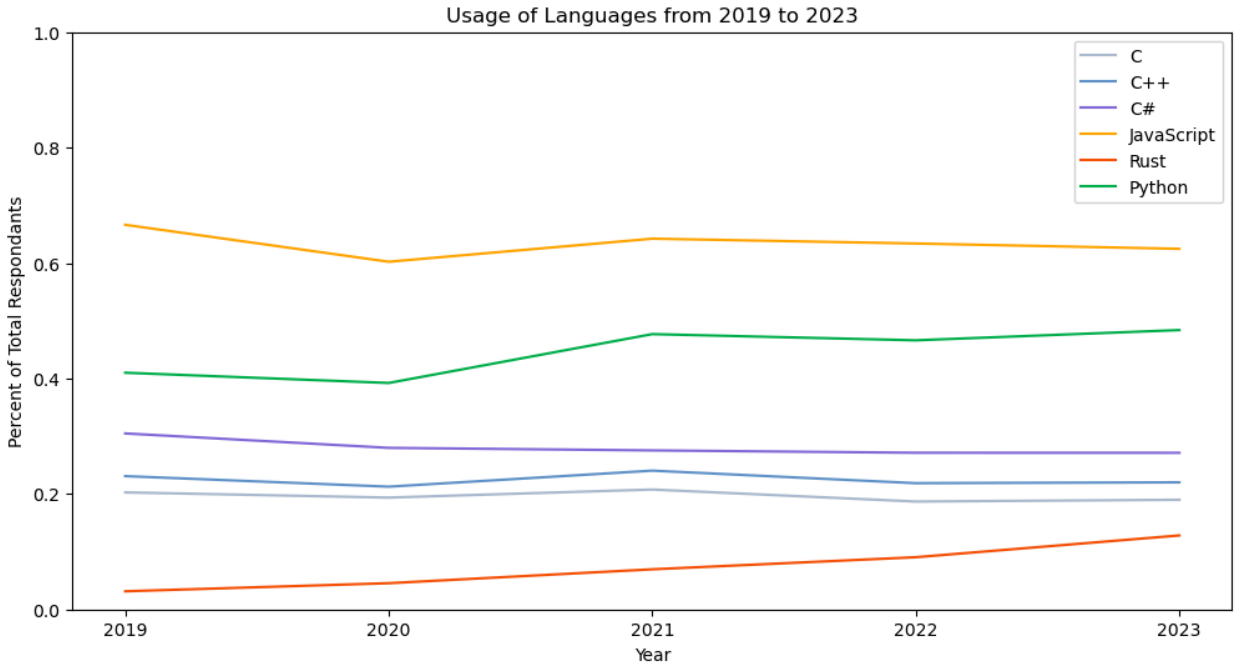


Fig.2.a: A line graph of the usage of select languages from 2019 to 2023.

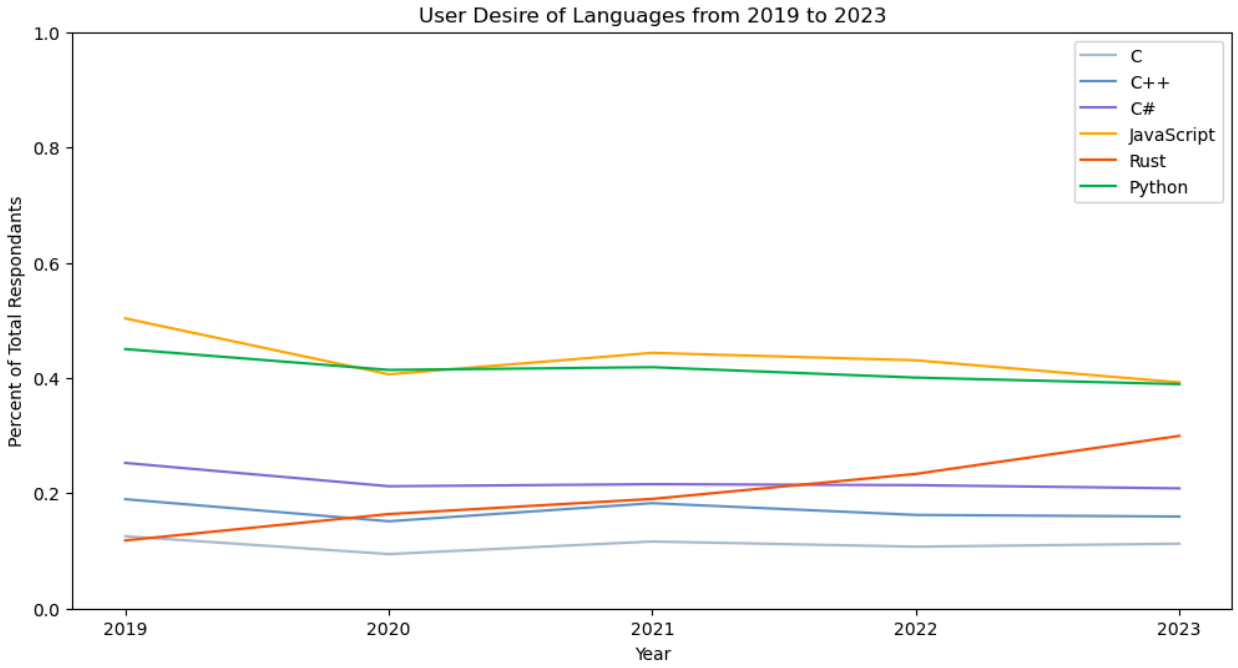


Fig.2.b: A line graph of the usage of select languages from 2019 to 2023.

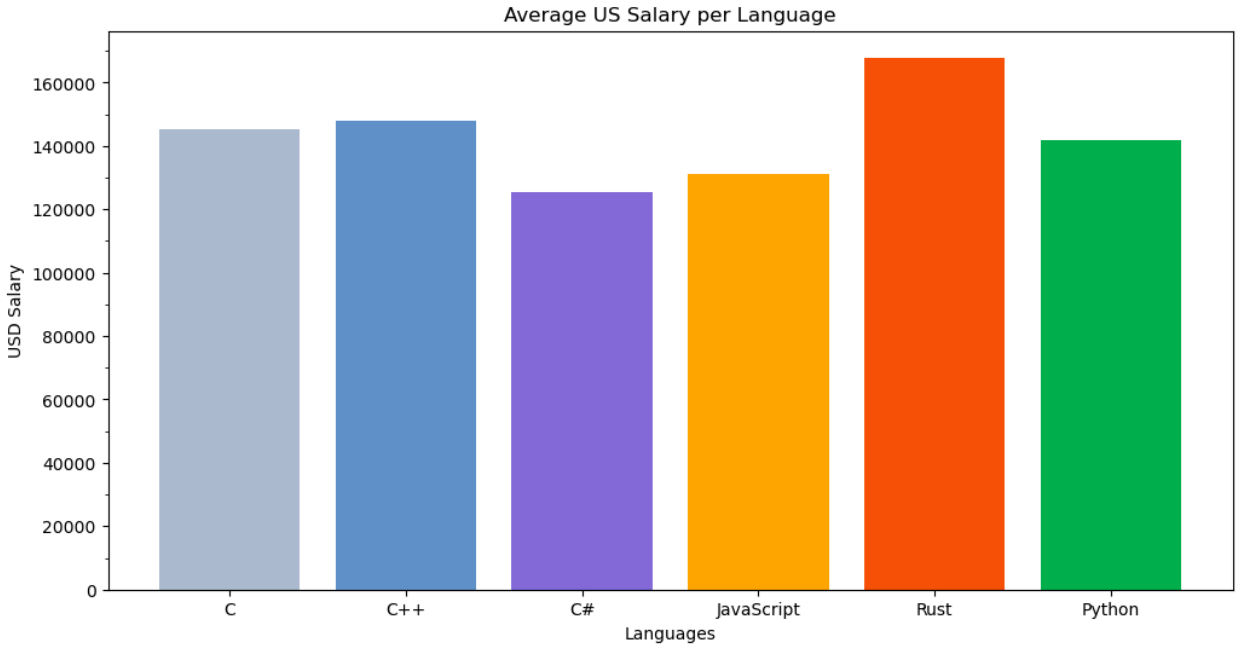


Fig.2.c: A bar graph of the average salary of select languages from 2019 to 2023.

Limitations

1. Geographical Scope: Salary calculations are limited to the United States
2. Survey Restrictions: Unfortunately because of the laws on import and export of data in the United States the survey could not be distributed in Crimea, Cuba, Iran, North Korea, and Syria.
3. Some regions represented unevenly (see Fig.3.a)

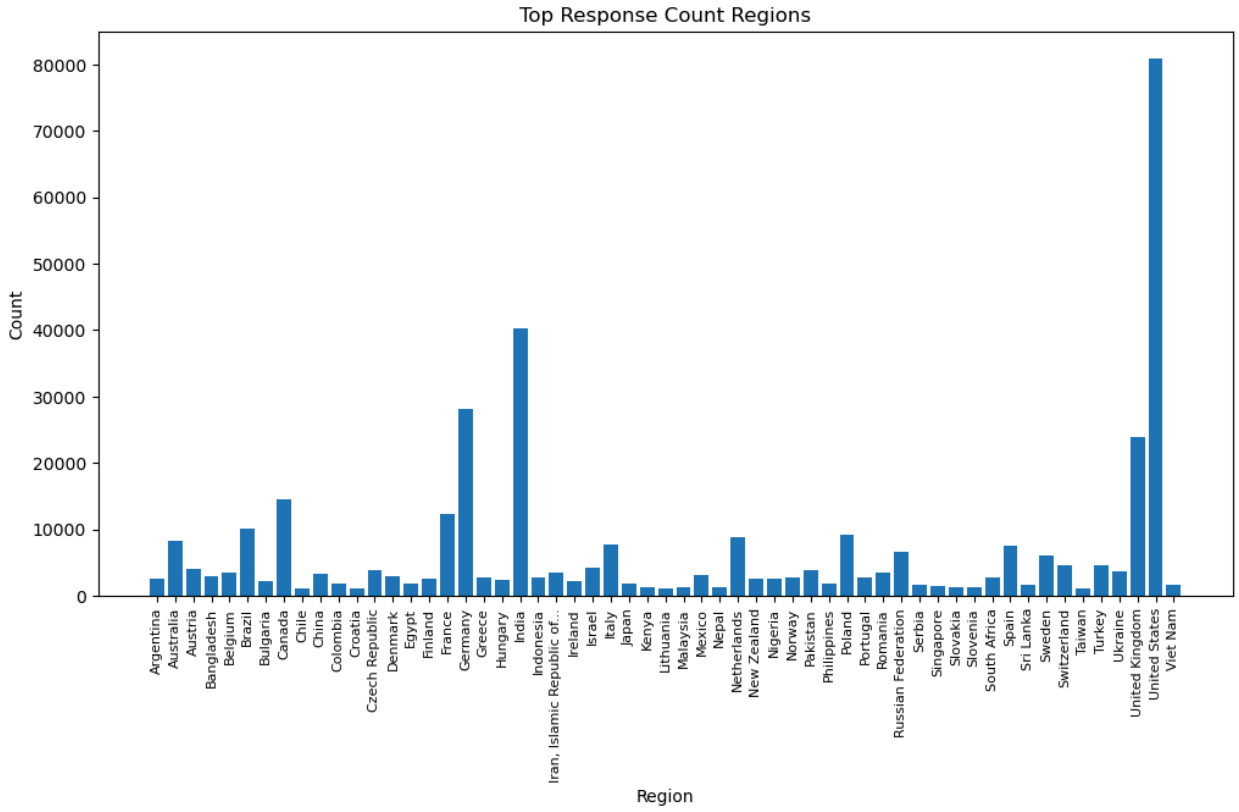
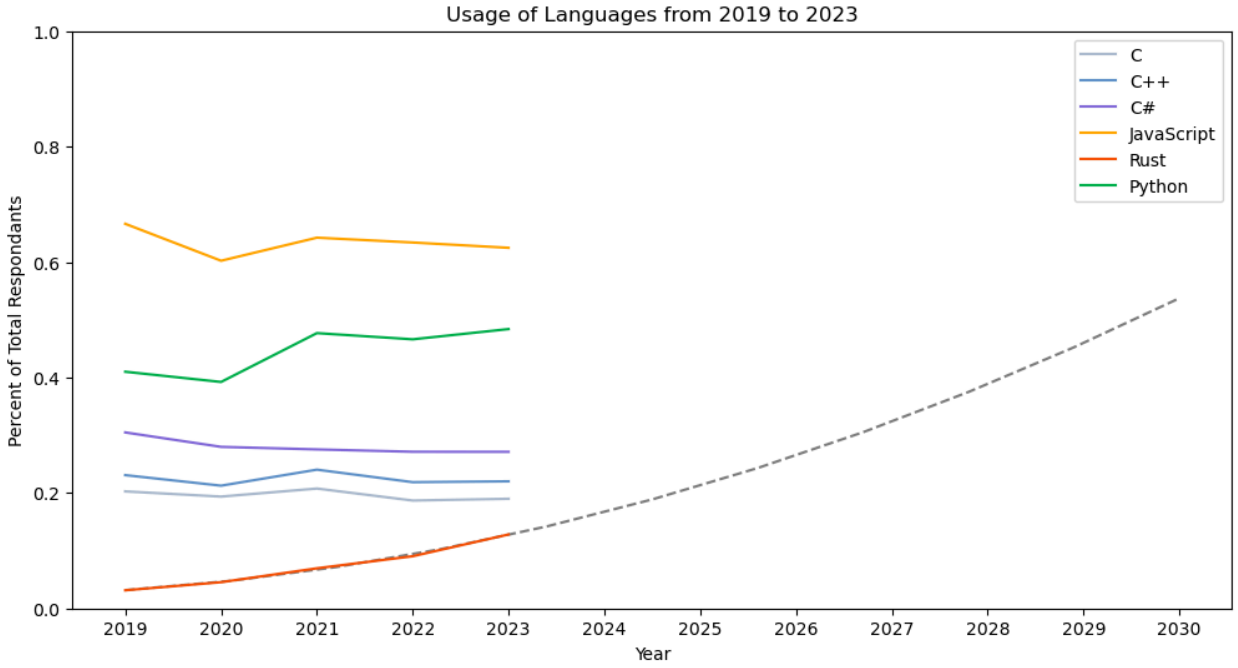


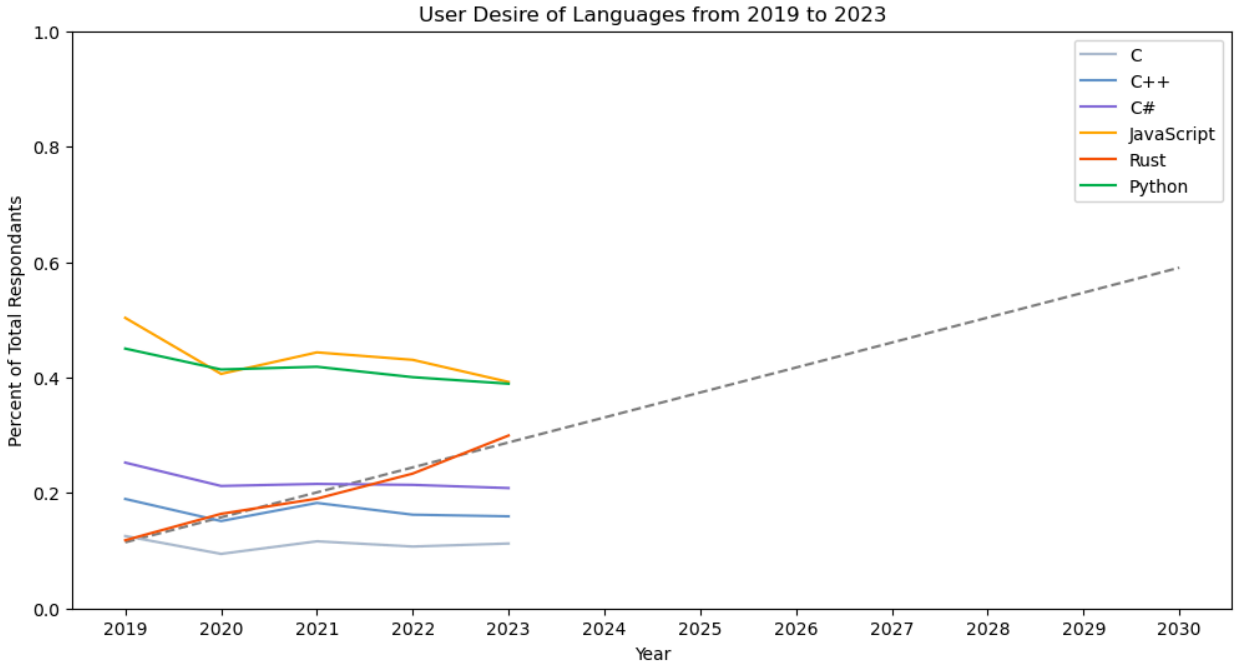
Fig.3.a: A bar graph of the total respondents from regions with over 1000 responses.

Predictions

Rust Usage



Rust Desire



Conclusion

Based on data analyzed from the StackOverflow and JetBrains surveys, Rust is emerging as a highly desirable programming language. This desirability is reflected in several key aspects, including its strong salary potential and high user satisfaction rate. Rust's emphasis on safety, concurrency, and performance has made it a favorite among developers who value these features in modern software development. The language's robust ecosystem, which includes excellent tooling, libraries, and community support, further enhances its appeal.

In contrast, JavaScript, while still a dominant force in web development, shows lower desirability and salary potential according to the same surveys. Despite its widespread use and importance in creating interactive web applications, these factors suggest that JavaScript may not offer the same level of long-term career satisfaction and financial benefits as other languages like Rust. This could be attributed to the market saturation and the prevalence of JavaScript in more entry-level or front-end positions, which may not command as high salaries as other specialized roles.

For newly learning software engineers, particularly those based in the United States, Rust presents a promising career path. The language's growing popularity, coupled with its impressive ecosystem and high user satisfaction rates, make it an attractive option for a primary programming language. Rust's focus on providing a reliable and efficient programming experience can be especially beneficial for engineers interested in systems programming, embedded systems, or performance-critical applications.

References

JetBrains Team. (2023, November 20). *The state of developer ecosystem in 2023 infographic*. JetBrains. https://www.jetbrains.com/lp/devecosystem-2023/

Lutz, X. P. (2024, June 22). *BTWFH/the-best-programming-language-to-learn*. GitHub. https://github.com/BTWFH/The-Best-Programming-Language-to-Learn

Rust Survey Team. (2024, February 19). *2023 annual Rust survey results: Rust blog*. The Rust Programming Language Blog. https://blog.rust-lang.org/2024/02/19/2023-Rust-Annual-Survey-2023-results.html

Stack Overflow. (2022, July 1). *Stack Overflow Surveys*. Stack Overflow Insights - Developer Hiring, Marketing, and User Research. https://survey.stackoverflow.co/