

Unlock your potential and master web development

PROGRAMMING STEP BY STEP AND MORE INSTRUCTIVE

UP-TO-DATE, VERSATILE, ADVANCED

BOOK 4 - Part Four

Mastering JavaScript: Classes,
Advanced Inheritance,
Polymorphism, Patterns, Modern
Principles, Refactoring, and Lifecycle
Management

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DEDICATION

TO THE GENERATIONS OF THE FUTURE, MILLENNIALS, BABY BOOMERS AND BEYOND.

This How-To is dedicated to everyone: To you, the brilliant young minds shaping the world with your ingenuity and creativity. To the millennials, who navigate the digital age with ease and constantly seek new ways to innovate. To the baby boomers, who pioneered the technological revolution and now contribute their experience and wisdom. To the retirees who dream of staying up-to-date, filling their free time with useful hours, and exercising their minds.

PROLOGUE

BOOK 4 – Part Four, *Mastering JavaScript: Classes, Advanced Inheritance, Polymorphism, Patterns, Modern Principles, Refactoring, and Lifecycle Management*, continues the journey of the **PROGRAMMING STEP BY STEP AND MORE** series into intermediate and advanced territory, further expanding its comprehensive approach to the JavaScript language. This volume follows the evolution of modern web development while strengthening the reader’s technical abilities through more than 600 practical exercises, providing valuable resources and up-to-date tools to excel in today’s competitive professional landscape.

In this fourth volume, readers will find a clear and in-depth exploration of **JavaScript classes**, covering essential concepts that enable developers to use this powerful feature efficiently and effectively. Throughout the chapters, both theory and practice are presented side by side, supported by concise examples and real-world exercises designed to ensure a solid understanding of how classes work and how to apply them in modern applications.

Book 4 – Part Four of the *Programming Step by Step and More: Instructional Guide* series stands as a meaningful contribution to the developer community, offering a strong foundation for contemporary web architecture. This series not only reflects the author’s dedication but also showcases their ability to communicate advanced concepts in a clear, structured, and accessible way.

On a personal note, I hold deep admiration for the author’s passion for teaching—an enthusiasm that shines through every page of this series and its unique learning system. Their talent for organizing information, simplifying complex ideas, and maintaining an unwavering commitment to excellence makes this work an invaluable resource for any aspiring developer.

With admiration and gratitude,

Idalmy Baluja Conde

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GRATITUDE

To my family, my colleagues, my friends.

Thank you, thank you so much for the unconditional support you've given me since I started this project. And to those who didn't believe in me, I'm grateful for motivating me to prove that it was worth it.

Without the encouragement, suggestions, trust they placed in me, and the personal challenge of creating a useful product, this project would not have been possible.

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BOOK 4 - Part Four

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1 OBJECTIVES AND SCOPE OF BOOK 4

The “*Programming Step by Step and More: Instructional Guide*” series has established itself as a premier resource for individuals seeking to master programming and web design. Built upon a clear, structured methodology supported by a Learning Management System, the series equips readers with the technical and conceptual foundations required to develop dynamic, efficient, and professional-grade web applications.

This fourth volume advances the study of JavaScript to a higher academic and practical level, introducing readers to cutting-edge concepts and modern development techniques. Beyond deepening the understanding of the language, this book guides learners into the broader domain of web application architecture. Throughout its chapters, we examine instance and static methods, class properties, advanced inheritance models, polymorphism, design patterns, SOLID principles, composition versus inheritance, object-oriented refactoring, advanced data types, serialization and deserialization, and class lifecycle management. Each chapter integrates theory with extensive hands-on practice, offering dozens of real-world exercises designed to reinforce learning and strengthen professional programming skills.

We recognize that the future of web development lies at the intersection of JavaScript and Artificial Intelligence. As AI technologies continue to evolve, JavaScript remains a central tool for building intelligent, interactive, and adaptive web applications. Future editions of the *Programming Step by Step and More* series will continue to provide the foundational knowledge required to integrate AI solutions using JavaScript. Volume 4 represents a significant step toward that objective.

Topics Covered in Book 4 – Part Four of “Programming Step by Step and More: Instructional Guide”

1. Introduction
2. Instance Methods and Static Methods

3. Class Properties
4. Advanced Inheritance
5. Advanced Polymorphism
6. Design Patterns with Classes
7. Fundamental Principles of Object-Oriented Software Design (SOLID Principles)
8. Composition vs. Inheritance
9. Object-Oriented Code Refactoring: Classes and Modules
10. Classes, Advanced Data Types, Serialization and Deserialization
11. Class Lifecycle Management

Includes more than 60 practical exercises and applied activities.

In essence, this volume not only provides the technical competencies required to build and publish professional-quality web applications but also supports continuous learning in a rapidly evolving technological landscape. The combination of rigorous theory, practical exercises, and coverage of modern tools makes this Instructional Guide an exceptional resource for learners at all levels.

Investing time in mastering programming languages and web development yields substantial benefits in the short, medium, and long term. Beyond technical proficiency, readers will discover how these skills enhance personal and professional opportunities, expand social and collaborative networks, and contribute to a higher quality of life.

CONCLUSIONS BOOK 4, PART FOUR

In this Book 4. Fourth Part we have offered an in-depth study of JavaScript classes, from the fundamentals to advanced techniques, with a strong focus on practical application through real-life examples.

We began by exploring the modular structure of classes, their syntax, and functionalities, establishing a solid foundation for further learning. Instance and static methods were clearly distinguished, and we understood when and how to use each to optimize code.

We delve into the properties of the class, its components and advantages, demonstrating its application through get and set methods.

Private properties (#) were introduced, emphasizing their importance for code encapsulation and security, as well as their use with get and set control methods.

We explored the inheritance model, analyzing its limitations and presenting practical solutions with mixins to simulate multiple inheritance and solve the diamond problem. Advanced polymorphism was broken down, including overloading, parametric polymorphism, subtype polymorphism, and ad hoc polymorphism, demonstrating its application in class hierarchies.

We delve into creational, structural, and behavioral design patterns, applying each to practical scenarios to understand their usefulness in creating robust software.

The SOLID principles were explained, demonstrating how to apply them to write clean, maintainable, and scalable code.

Composition was compared to inheritance, highlighting the advantages of composition and how to avoid deep inheritance.

Code refactoring was addressed, showing how to improve the quality and performance of classes. Class modularization was explored, using import and export to organize code and create modular structures.

The use of classes with advanced data types such as Map, Set and WeakMap, as well as with Promises, was demonstrated.

The serialization and deserialization of class objects was explained, showing how to implement custom methods such as toJSON.

The management of the class lifecycle was addressed, including the implementation of patterns to handle the creation, use and destruction of instances, the use of static methods as initializers, the implementation of

interfaces and the simulation of interfaces through abstract classes or conventions.

Unit testing and TDD (Test-Driven Development) were introduced, showing how to use Jest to ensure code quality.

Throughout the guide, dozens of practical examples and real-world exercises were provided to reinforce learning and demonstrate the application of concepts in real-world scenarios. Critical thinking and problem-solving skills were encouraged, preparing readers to face the challenges of modern software development.

In summary, this tutorial has provided comprehensive and practical training in JavaScript classes, equipping readers with the skills and knowledge needed to create robust, scalable, and maintainable applications.

REFERENCIAS

1. MDN Web Docs - Clases. Explicaciones detalladas sobre métodos de instancia, métodos estáticos, propiedades, herencia y polimorfismo.
2. "Eloquent JavaScript" de Marijn Haverbeke.
3. "You Don't Know JS: Classes & Prototypes" de Kyle Simpson.
4. "Design Patterns: Elements of Reusable Object-Oriented Software" (Gang of Four)
5. "Clean Code: A Handbook of Agile Software Craftsmanship" de Robert C. Martin:
6. Refactoring.Guru . <https://refactoring.guru/es/>
7. TypeScript Documentation - <https://www.typescriptlang.org/docs/>
8. JavaScript Testing Framework - <https://jestjs.io/es-ES/>
9. "Mastering JavaScript Object-Oriented Programming" de Andrea Chiarelli
10. "The Principles of Object-Oriented JavaScript" de Nicholas C. Zakas
11. JavaScript: The Good Parts" de Douglas Crockford
12. JavaScript Design Patterns en DigitalOcean – Tutoriales <https://www.digitalocean.com/community/tutorial-series/javascript-design-patterns>

MOTIVATIONAL PHRASES.

"Success is the sum of small efforts repeated day after day."

Robert Collier

"The only limit to your fulfillment tomorrow will be your doubts today."

Franklin D. Roosevelt

"It doesn't matter how slow you go as long as you don't stop."

Confucius

"The path to success and greatness is to develop what you already have."

ZigZiglar

"The secret of success lies in knowing more than others."

Aristotle Onassis

"It's not about how many times you fall, but how many times you get up."

Vince Lombardi

"Success is not the key to happiness. Happiness is the key to success. If you love what you do, you will be successful."

Albert Schweitzer

"The only way to do great work is to love what you do."

Steve Jobs

"The biggest risk is not taking any risks. In a world that's changing so fast, the only strategy that's guaranteed to fail is not taking risks."

Mark Zuckerberg

"Motivation drives us to begin, and habit keeps us going."

Jim Ryun

"It's not enough to tell the truth; you have to prove that you have it."

Baltasar Gracián

If you can't fly, run; if you can't run, walk; if you can't walk, crawl, but keep moving toward your goal."

Martin Luther King Jr

"No matter your physical age, you can always motivate your mind to face tomorrow."

From the Author

ABOUT THE AUTHOR.

After several decades dedicated to improving the energy efficiency of heating and cooling equipment and systems, I faced a major life change: retirement. Upon retiring, I felt disoriented and without purpose, which affected my emotional well-being. To combat this feeling, I sought a new occupation that would keep me active and motivated.

I decided to share my experiences and knowledge accumulated over more than four decades of work in the industry. This project emerged from that decision, with the goal of publishing articles, calculation tools, and tutorials on the various disciplines in which I had worked throughout my career as an engineer. I acquired these computer skills and knowledge through self-study, delving into technical, theoretical, and practical topics. This includes web programming, which I used as a supporting tool to optimize project management, investments, finances, and marketing.

From personal experience, web programming is a powerful tool, key to solving complex problems in industrial settings, technical services, and everyday life.

My new perspective on the future, centered on the information technology revolution, has been crucial in keeping my mind active, staying up-to-date, and empirically learning new technologies. In this context of constant and accelerated change, my vision expands towards a horizon where AI not only optimizes processes but also redefines industries and creates previously unimaginable opportunities.

This tutorial highlights the importance of programming languages as essential tools in the modern world and is designed to support people of all ages in developing their professional skills and achieving their career goals. It provides valuable resources for both those starting their careers and those seeking new ways to apply their experience. Furthermore, learning a new programming language is presented as an excellent way to make productive use of free time, enhance one's resume, and stay current in an increasingly digital world.

The Author

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