Unlock your potential and master web development

PROGRAMMING STEP BY STEP AND MORE AN INSTRUCTIVE GUIDE

UP-TO-DATE, VERSATILE, ADVANCED

Book 5 - Part Five

Software Engineering for the New Digital Age. JavaScript, TypeScript, and AI. Scalable Business Solutions.

Rene F. Ruano Domínguez

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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 5 – Fifth Part. Software Engineering for the New Digital Era. JavaScript, TypeScript, and AI. Scalable Business Solutions

In today's fast-moving and demanding New Digital Era, where the ability to innovate and build efficient, scalable software solutions is more critical than ever, this volume serves as an essential guide. As part of the *Programming Step by Step and More* series, Book 5 responds to the growing need to bridge the gap between solid programming fundamentals and the expanding frontiers of Artificial Intelligence. It is designed for learners and professionals who want to update their skills, master advanced topics, and understand how modern software engineering continues to evolve at an accelerated pace.

The author has structured this book to present complex concepts clearly and efficiently through a systematic, practical approach. It begins with mastering TypeScript to write clean, robust, and modular code, and through hands-on projects and performance-focused challenges, readers learn to turn complex ideas into efficient, high-quality, and maintainable implementations.

What sets this volume apart is its deep exploration of how JavaScript and TypeScript integrate with Artificial Intelligence, demonstrating how AI models—such as Natural Language Processing and Computer Vision—can be embedded directly into applications to enhance interaction and functionality.

This work reflects the author's strong commitment to excellence and passion for teaching, offering a meaningful contribution to the community of innovators. His ability to simplify complex concepts and his dedication to knowledge sharing make this book an invaluable resource, providing a solid foundation for modern software design and practical guidance for developers aiming to master the technologies that will define the digital future

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.

Book 5 - Part Five

Software Engineering for the New Digital Age. JavaScript, TypeScript, and AI. Scalable Business Solutions.

Rene F. Ruano Domínguez

OBJECTIVES AND SCOPE OF BOOK 5

The *"Programming Step by Step and More: Instructional Guide"* series is a definitive resource for anyone who wants to master programming and web design. Through a clear and concise methodology supported by a Learning Management System, these books give readers the skills needed to become fully capable developers, able to build dynamic and efficient web applications.

Book 5 is an essential guide for today's digital world. Throughout its chapters, we dive into the TypeScript paradigm—an indispensable tool that transforms the way we structure and reason about code. We explore the power of classes and types to build robust, maintainable systems, applying these techniques to real-world challenges such as inventory management, where every cost-calculation or calorie-consumption algorithm must be precise and scalable.

Beyond functional correctness, this book walks you through advanced performance-optimization strategies, showing how to refactor and improve classes for user and product management, ensuring fast, secure, and reliable applications. We also highlight the importance of professional code documentation with JSDoc, a key practice for long-term collaboration and maintainability. The journey concludes with the integration of JavaScript and TypeScript with Artificial Intelligence, offering a practical look at how NLP models, computer vision, recommendation systems, and more can be embedded directly into your applications. This learning path empowers you to build software that not only works—but learns, adapts, and delivers truly intelligent experiences.

Topics Covered in Book 5 – Fifth Part
Objectives and Scope of Book 5
Classes and Types in TypeScript
Performance and Optimization
Complex Integration Exercises
The Fusion of JavaScript and Artificial Intelligence to Master the Innovative Future
Includes more than 40 hands-on exercises and practical activities.

In summary, this learning journey will not only strengthen your technical skills for designing robust and optimized software, but also position you at the forefront of AI-driven development. This volume is a valuable, methodically crafted resource for developers who want to master the tools and practices that drive innovation.

By investing your time in this learning process, you will not only master key languages and architectures—you will gain the ability to build intelligent systems that deliver meaningful, high-impact value. The combination of theory and practical projects will help you turn your ideas into powerful software solutions, positively shaping your professional path and opening new opportunities for creating smart business applications.

CONCLUSIONS BOOK 5, PART FIVE

This tutorial consolidated the fundamentals of TypeScript, from a comparative analysis of dynamic and static typing to the definition and use of advanced classes. It covered the benefits of TypeScript in providing greater security and clarity in class design, the configuration of key tools such as ESLint and Prettier, and the step-by-step creation of an inventory management project. Furthermore, the development of algorithms for calculating costs and caloric expenditure, along with the implementation of inheritance and interfaces, completes a comprehensive overview of the possibilities offered by TypeScript.

Next, performance and optimization techniques focused on a user management web application were explored. The initial problem was presented, along with its efficient solution using the bcryptjs library and Webpack. The entire development workflow, including local testing and the generation of optimized bundles, was illustrated. This chapter emphasizes how to apply bundling and hashing tools to reduce load times and ensure data integrity in production projects.

The complex integration exercises section presented challenges in modularization and design patterns within practical scenarios: instrument control, fuel management in tankers, and airport admission processes. The combination of classes, prototypes, singletons, and observers forms a set of real-world examples that demonstrate how to structure scalable and maintainable systems, as well as the importance of documenting each component to facilitate its evolution.

Finally, the fusion of JavaScript and artificial intelligence allowed participants to become familiar with language models, computer vision, recommendations, and machine translation, as well as their integration into web applications. Strategies for optimizing HTTP requests, incorporating widgets like Google Translate, and building AI algorithms in the browser were analyzed. The culminating project, Energyner_Translator, showcased the complete deployment on Google Cloud, covering everything from credentials and API limits to creating container images and configuring services.

With all of the above, the reader gains a clear and practical understanding of TypeScript, performance optimization, advanced modularization, and the integration of artificial intelligence in web environments. This guide lays the foundation for developing robust, scalable, and industry-standard solutions, preparing you to tackle real-world projects with confidence and efficiency.

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Free service for testing REST APIs, useful for learning how to consume JSON data.

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    Documentation on integrating intelligent search engines into web applications.
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    Tool for documenting JavaScript code and automatically generating HTML documentation.
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    Official documentation for applying artificial intelligence models on the web using JavaScript.

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 systems, I faced a major life change: retirement. Stepping away from my professional routine left me feeling disoriented and without purpose, which affected my emotional well-being. To overcome this, I sought a new activity that would keep me engaged and motivated.

I decided to share the experience and knowledge accumulated over more than forty years in the industry. This project was born with the goal of publishing articles, calculation tools, and instructional materials related to the various disciplines I worked with throughout my engineering career. My technical and computing skills were developed independently, deepening my understanding of theoretical and practical topics. This included web programming, which I used as a complementary tool to optimize project management, investments, finance, and marketing.

From firsthand experience, I can affirm that web programming is a powerful tool for solving complex problems in industrial environments, technical services, and everyday life.

My new outlook on the future—focused on the ongoing digital revolution—has helped me stay mentally active, continue learning, and explore new technologies through practice. In this fast-changing landscape, my perspective expands toward a horizon where AI not only optimizes processes but also reshapes industries and creates opportunities once unimaginable.

This instructional guide 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 offers valuable resources both for those beginning their journey and for those seeking new ways to apply their experience.

The Author

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Published in Paperback and Digital

Miami, Florida, USA · 2025

English-language edition © 2025 René F. Ruano Domínguez

Translated from Spanish by René F. Ruano Domínguez

Originally published in Spanish as

*'***PROGRAMMING STEP BY STEP AND MORE ®**

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Publisher: Corporate Luxury Group, LLC