

Guide2Code - Rust Programming Roadmap

Phase I: Beginner Level

Topics to Learn:

1. Introduction to Rust (Installation, Cargo, Rust Toolchain)
2. Variables & Data Types (Scalar & Compound Types)
3. Ownership & Borrowing (Move, Copy, Clone, References)
4. Control Flow (if-else, match, loops)
5. Functions & Scope (Closures, Function Pointers)
6. Structs & Enums (Pattern Matching, Associated Functions)
7. Collections (Vectors, HashMaps, Strings)
8. Error Handling (Result, Option, unwrap, expect)
9. File Handling (Reading/Writing Files, JSON Parsing)
10. Debugging & Testing (assert!, panic!, Unit Testing)

Beginner Project Ideas:

- **Simple Calculator** – Basic arithmetic operations
- **To-Do List CLI** – Command-line task manager
- **Age Calculator** – Compute age based on birth year
- **Temperature Converter** – Convert between Celsius & Fahrenheit
- **Contact Manager** – Store and retrieve contacts using JSON

Phase 2: Intermediate Level

Topics to Learn:

1. Ownership Deep Dive (Lifetimes, Smart Pointers, Box, Rc, Arc)
2. Traits & Generics (Type Abstraction, Polymorphism)
3. Iterators & Closures (map, filter, collect)
4. Concurrency (Threads, Mutex, Channels, async/await)
5. File I/O & Serialization (serde, toml, JSON, CSV)
6. Working with Databases (SQLx, Diesel, PostgreSQL)

7. Web Development with Rust (Actix-web, Rocket)
8. Web Scraping with Rust (reqwest, scraper)
9. Testing & Benchmarking (criterion, doctests)
10. Logging & Error Handling (tracing, log, anyhow)

Intermediate Project Ideas:

- **URL Shortener** – Generate short URLs and store them
- **RESTful API** – CRUD API using Actix-web or Rocket
- **Web Scraper** – Extract data from websites
- **Markdown Parser** – Convert Markdown to HTML
- **Basic Chat Application** – Real-time chat with WebSockets

Phase 3: Advanced Level

Topics to Learn:

1. Advanced Concurrency (Tokio, Rayon, Actor Model)
2. System Programming (Memory Management, Low-Level APIs)
3. Networking & WebSockets (Hyper, Warp, Axum)
4. Cryptography & Security (RustCrypto, JWT, TLS)
5. Blockchain Development with Rust (Substrate, Solana)
6. Game Development with Rust (Bevy, ggez)
7. Embedded Systems (Rust for IoT, no_std)
8. Machine Learning in Rust (ndarray, tch-rs)
9. Performance Optimization & Profiling (flamegraph, pprof)
10. Cloud Deployment (AWS Lambda, WASM, Docker)

Advanced Project Ideas:

- **High-Performance Web Server** – Build a lightweight web server
- **Decentralized File Storage** – Implement a peer-to-peer file system
- **AI-Powered Sentiment Analysis** – NLP with Rust
- **IoT Data Processor** – Rust-based real-time IoT analytic