



To discuss this course and customizations:
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Rust for C# Programmers

Class Duration

- 5 days of comprehensive training
- Seamless transition for C# developers

Target Audience

- Proficiency in C# programming
- Basic understanding of programming concepts such as variables, expressions, functions, and control flow

Description

The Rust for C# Developers course offers a seamless transition for experienced C# developers looking to unlock the power of Rust. Leveraging your existing knowledge in object-oriented programming, this course introduces you to Rust's innovative features, including its ownership model, memory safety, and fine-grained control over system resources. Explore Rust's syntax, libraries, and tools while mastering concepts like pattern matching, concurrency, and error handling. By the end of this course, you'll be well-equipped to harness Rust's strengths, enabling you to write high-performance and secure systems-level software, making it an essential journey for C# developers seeking to broaden their programming horizons.

Learning Objectives

- Understand the Rust Philosophy
- Set Up and Navigate the Rust Environment
- Explore Rust within the context of C#
- Grasp Basic Rust Syntax and Semantics
- Learn Control Flow and Logic
- Learn Ownership and Borrowing Concepts
- Utilize Tuples, Enums, Structs, and Vectors
- Employ Pattern Matching
- Harness Rust's Concurrency Model
- Create Custom Macros
- Write Rust Tests
- Create Documentation with Rustdoc



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Training Materials

All students receive comprehensive courseware covering all topics in the course. Courseware is distributed via GitHub in the form of documentation and extensive code samples. Students practice the topics covered through challenging hands-on lab exercises.

Software Requirements

Students will need a free, personal GitHub account to access the courseware. Students will need permission to install Rust and Visual Studio Code on their computers. Also, students will need permission to install Rust Crates and Visual Studio Extensions. If students are unable to configure a local development environment, a cloud-based environment can be provided.

Training Topics

Introduction

- What is Rust?
- Rust's Philosophy and Goals
- History and motivation
- Rust vs C# & .NET
- Rust Community
- The Rust Playground

Install Rust

- Script
- macOS Homebrew
- Platform Installers

Rust Editors

- VSCode with Extensions
- Rust Rover
- Debug Rust in VSCode
- GitHub Copilot

Hello World

- Create a new Project
- Main Function
- Print to the Console



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- Comments

Cargo

- What is Cargo?
- How does Cargo compare to NuGet and dotnet CLI?
- Rust Crates compared to NuGet Packages
- Run Command
- Build Command
- Build Release Command
- Install Third-Party Crates

Popular Cargo Crates

- Serde
- Tokio
- Reqwest
- SQLx
- Anyhow

Rust and C# Differences

- Memory Management
- Error Handling
- Sequence, Selection, and Iteration
- Structs vs Classes
- Traits vs Interfaces
- Generics
- Concurrency

Scalar Types and Data

- Rust Types vs C# Types
- Constants
- Immutable Variables
- Mutable Variables

Code Logic

- If Statement
- Loop with Break
- While Loop



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Functions

- Define a Function
- Call a Function
- Parameter Types
- Return Types
- Closure Functions

Modules

- Import Modules from Standard Library
- Import Modules from Third-Party Crates
- Define Custom Modules
- Import Custom Modules

Built-In Macros

- `print!` and `println!`
- `format!`
- `vec!`
- `include_str!` and `include_bytes!`
- `cfg!` and `env!`
- `panic!`

Memory Management

- Problems with Manual Management
- Problems with Garbage Collection
- Ownership & Borrowing
- Rust vs C#
- References
- Lifetimes

Strings

- String Slices
- String Objects
- Convert Between Slices and Strings
- Parse Number from String
- Trim String
- Print Strings with Interpolation



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Tuples

- What is a Tuple?
- Rust Tuples vs. C# Tuples
- Heterogeneous Elements
- Access Elements
- Destructuring
- Immutable

Enums

- What is an Enum?
- Rust Enums vs. C# Enums
- Define an Enum
- Using Enums
- Enum Variants
- Enum Methods
- Enums and Pattern Matching
- Result Enum
- Option Enum
- Enums vs Structs

Structs

- What is a Struct?
- Rust Structs vs. C# Structs
- Create Instance
- Field Init Shorthand
- Struct Update Syntax
- Tuple Structs
- Unit-Like Structs
- Ownership of Struct Data
- Function Implementation
- Associated Functions
- Struct Methods
- Constructor Pattern

Vectors

- What is a Vector?
- Rust Vectors vs. C# Lists



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- Create a Vector
- Add and Remove Elements
- Access Elements
- Iterate over Elements
- Slicing, Length, and Capacity
- Common Vector Operations
- Understand Memory Management
- Ownership and Borrowing Rules

Collections and Iterators

- Vectors, arrays, and slices
- HashMaps and hash sets
- Iteration and iterators

Traits

- What is a trait?
- How does a trait related to C# interfaces?
- Defining a trait
- Implementing a trait
- Default implementations
- Traits as parameters
- Traits as return types
- Traits as bounds

Generics

- What is a generic?
- How does a generic related to C# generics?
- Defining a generic
- Implementing a generic
- Generic bounds
- Multiple generic types
- Where clauses

Pattern Matching

- What is Pattern Matching?
- Match Statement
- If Let Statement
- While Let Statement



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- Destructuring Structs and Tuples
- Pattern Matching with Enums
- Pattern Matching with Functions
- Pattern Matching and Ownership
- Refutability and Irrefutability

Concurrent Programming

- What is Concurrent Programming?
- Using Multiple Threads
- Mutex, RwLock, and Arc
- Message Passing with Channels
- Sync and Send Traits
- Futures and Async/Await

Unsafe Rust

- What is Unsafe Rust?
- Raw Pointers
- Dereferencing Raw Pointers
- Calling Unsafe Functions
- Creating Safe Abstractions
- Unsafe Traits
- Unsafe Blocks
- Unsafe Superpowers

Macros and Metaprogramming

- What is a Macro?
- Define a Macro with `macro_rules!`
- Using Pattern Matching
- Define Expansion
- Use the Custom Macro

Tests

- What is a Test?
- Test Functions
- Test Organization
- Test Attributes
- Test Coverage
- `assert!`, `assert_eq!`, and `assert_ne!`



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Documentation with Rustdoc

- What is Rustdoc?
- Add Documentation to Rust Code
- Triple-Slash Comments and the `#[doc]` Attribute
- Generate Documentation
- Linking and Cross-Referencing Documentation

Conclusion

- Course wrap-up and next steps