Template Metaprogramming with C++

Learn everything about C++ templates and unlock the power of template metaprogramming

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C Template Metaprogramming

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C Template Metaprogramming:

Template Metaprogramming with C++ Marius Bancila,2022-08-19 Understand how to use modern C templates for writing maintainable robust and fast software Key Features Grasp the fundamentals of and learn to write effective C templates Get up to speed with the latest C 20 template features such as constraints and concepts Explore different patterns and idioms to integrate templates in your program design Book Description Learn how the metaprogramming technique enables you to create data structures and functions that allow computation to happen at compile time With this book you ll realize how templates help you avoid writing duplicate code and are key to creating generic libraries such as the standard library or Boost that can be used in a multitude of programs The introductory chapters of this book will give you insights into the fundamentals of templates and metaprogramming You ll then move on to practice writing complex templates and exploring advanced concepts such as template recursion template argument deduction forwarding references type traits and conditional compilation Along the way you ll learn how to write variadic templates and how to provide requirements to the template arguments with C 20 constraints and concepts Finally you ll apply your knowledge of C metaprogramming templates to implement various metaprogramming patterns and techniques By the end of this book you ll have learned how to write effective templates and implement metaprogramming in your everyday programming journey What you will learn Understand the syntax for all types of templates Discover how specialization and instantiation works Get to grips with template argument deduction and forwarding references Write variadic templates with ease Become familiar with type traits and conditional compilation Restrict template arguments in C 20 with constraints and concepts Implement patterns such as CRTP mixins and tag dispatching Who this book is for This book is for beginner to intermediate C developers who want to learn about template metaprogramming as well as advanced C developers looking to get up to speed with the new C 20 features related to templates and the the various idioms and patterns Basic C coding experience is necessary to get started with this book   C++ Template Metaprogramming David Abrahams,Aleksey Gurtovoy,2004-12-10 C Template Metaprogramming sheds light on the most powerful idioms of today s C at long last delivering practical metaprogramming tools and techniques into the hands of the everyday programmer A metaprogram is a program that generates or manipulates program code Ever since generic programming was introduced to C programmers have discovered myriad template tricks for manipulating programs as they are compiled effectively eliminating the barrier between program and metaprogram While excitement among C experts about these capabilities has reached the community at large their practical application remains out of reach for most programmers This book explains what metaprogramming is and how it is best used It provides the foundation you ll need to use the template metaprogramming effectively in your own work This book is aimed at any programmer who is comfortable with idioms of the Standard Template Library STL C power users will gain a new insight into their existing work and a new fluency in the domain of metaprogramming Intermediate level programmers who have learned

a few advanced template techniques will see where these tricks fit in the big picture and will gain the conceptual foundation to use them with discipline Programmers who have caught the scent of metaprogramming but for whom it is still mysterious will finally gain a clear understanding of how when and why it works All readers will leave with a new tool of unprecedented power at their disposal the Boost Metaprogramming Library Note CD materials are only available with the print edition

Advanced Metaprogramming in Classic C++ Davide Di Gennaro,2015-05-08 Advanced Metaprogramming in Classic C aims to be both an introduction and a reference to C template metaprogramming TMP TMP is presented in the book as a set of techniques that will bring a new style in C and make code exceptionally clear and efficient The book deals with language aspects design patterns examples and applications seen as case studies Special emphasis is put on small reusable techniques that will improve the quality of daily work What makes the book exceptional is the level of understanding of the concepts involved imparted by the author This is not just a rote overview of metaprogramming You will truly understand difficult topics like static assertions how to write metafunctions overload resolution lambda expressions and many others More than that you will work through them with practical examples guided by the author s frank explanations This book requires you to think and to learn and to understand the language so that youcan program at a higher level   C++ Template Metaprogramming Martin C Morales,2025-09-07 C Template Metaprogramming A Guide to Crafting Elegant Efficient and Type Safe Code through Compile Time Computation takes you on a journey from first principles to advanced modern techniques This book demystifies a topic often seen as complex turning it into a practical powerful tool in your C arsenal You ll move from the what and why to building real world high performance components learning to leverage the full power of the C compiler Have you ever chased a bug that a simple unit mismatch could have prevented Have you ever struggled to optimize a critical loop bogged down by temporary objects What if you could write code that was proven correct by the compiler catching logical errors before you even hit run This book tells the story of that transformation We journey from the classic powerful but complex patterns of traditional template metaprogramming to the clean intuitive and expressive world of modern C 17 and C 20 You will learn to stop fighting the type system and start commanding it turning the compiler from a simple translator into your most powerful ally in the quest for correct high performance code What s Inside Inside you will discover how to Master the fundamentals from template specialization to variadic templates Replace complex recursion with clean modern constexpr functions Understand the evolution of conditional compilation from classic SFINAE to the superior if constexpr and C 20 Concepts Implement powerful design patterns like Policy Based Design Tag Dispatching and Expression Templates Build practical compile time projects including a Typelist a rational number class and a type safe dimensional analysis framework Learn to debug and unit test your compile time code effectively Who It s Meant For This book is for the intermediate to advanced C developer who is ready to unlock a new level of mastery It is essential for Library authors looking to build powerful zero overhead abstractions Developers in performance critical domains such as

high performance computing finance game development and embedded systems Programmers who want to understand the magic behind modern standard library components like and Any C engineer who wants to write safer more robust and more efficient code Stop just writing code It s time to command the compiler If you re ready to transform your approach to software design eliminate entire categories of bugs and unlock the ultimate performance C has to offer then this is the book you ve been waiting for Order your copy today and start building the future of high performance C **C++ Template Metaprogramming in Practice** Li Wei,2020-12-01 Using the implementation of a deep learning framework as an example C Template Metaprogramming in Practice A Deep Learning Framework explains the application of metaprogramming in a relatively large project and emphasizes ways to optimize systems performance The book is suitable for developers with a basic knowledge of C Developers familiar with mainstream deep learning frameworks can also refer to this book to compare the differences between the deep learning framework implemented with metaprogramming and compile time computing with deep learning frameworks using object oriented methods Consisting of eight chapters the book starts with two chapters discussing basic techniques of metaprogramming and compile time computing The rest of the book s chapters focus on the practical application of metaprogramming in a deep learning framework It examines rich types and systems expression templates and writing complex meta functions as well as such topics as Heterogeneous dictionaries and policy templates An introduction to deep learning Type system and basic data types Operations and expression templates Basic layers Composite and recurrent layers Evaluation and its optimization Metaprogramming can construct flexible and efficient code For C developers who are familiar with object oriented programming the main difficulty in learning and mastering C metaprogramming is establishing the thinking mode of functional programming The meta programming approach involved at compile time is functional which means that the intermediate results of the construction cannot be changed and the impact may be greater than expected This book enables C programmers to develop a functional mindset and metaprogramming skills The book also discusses the development cost and use cost of metaprogramming and provides workarounds for minimizing these costs **C++ Template Metaprogramming in Practice** Li Wei,2020-12-01 Using the implementation of a deep learning framework as an example C Template Metaprogramming in Practice A Deep Learning Framework explains the application of metaprogramming in a relatively large project and emphasizes ways to optimize systems performance The book is suitable for developers with a basic knowledge of C Developers familiar with mainstream deep learning frameworks can also refer to this book to compare the differences between the deep learning framework implemented with metaprogramming and compile time computing with deep learning frameworks using object oriented methods Consisting of eight chapters the book starts with two chapters discussing basic techniques of metaprogramming and compile time computing The rest of the book s chapters focus on the practical application of metaprogramming in a deep learning framework It examines rich types and systems expression templates and writing complex meta functions as well as such

topics as Heterogeneous dictionaries and policy templates An introduction to deep learning Type system and basic data types Operations and expression templates Basic layers Composite and recurrent layers Evaluation and its optimization Metaprogramming can construct flexible and efficient code For C developers who are familiar with object oriented programming the main difficulty in learning and mastering C metaprogramming is establishing the thinking mode of functional programming The meta programming approach involved at compile time is functional which means that the intermediate results of the construction cannot be changed and the impact may be greater than expected This book enables C programmers to develop a functional mindset and metaprogramming skills The book also discusses the development cost and use cost of metaprogramming and provides workarounds for minimizing these costs **Exploring C++** Ray Lischner,2009-02-07 Exploring C uses a series of self directed lessons to divide C into bite sized chunks that you can digest as rapidly as you can swallow them The book assumes only a basic understanding of fundamental programming concepts variables functions expressions statements and requires no prior knowledge of C or any other particular language It reduces the usually considerable complexity of C The included lessons allow you to learn by doing as a participant of an interactive education session You ll master each step in one sitting before you proceed to the next Author Ray Lischner has designed questions to promote learning new material And by responding to questions throughout the text you ll be engaged every step of the way *C++ Template Metaprogramming* David Abrahams,Aleksey Gurtovoy,2005 This book is aimed at any programmer who is comfortable with idioms of the Standard Template Library STL C power users will gain a new insight into their existing work and a new fluency in the domain of metaprogramming Intermediate level programmers who have learned a few advanced template techniques will see where these tricks fit in the big picture and will gain the conceptual foundation to use them with discipline Programmers who have caught the scent of metaprogramming but for whom it is still mysterious will finally gain a clear understanding of how when and why it works All readers will leave with a new tool of unprecedented power at their disposal the Boost Metaprogramming Library Jacket Effective C++ Scott Meyers,2005 The book is organized around 55 specific guidelines each of which describes a way to write better C Each is backed by concrete examples Cover **Professional C++** Marc Gregoire,2021-02-24 Improve your existing C competencies quickly and efficiently with this advanced volume Professional C 5th Edition raises the bar for advanced programming manuals Complete with a comprehensive overview of the new capabilities of C 20 each feature of the newly updated programming language is explained in detail and with examples Case studies that include extensive working code round out the already impressive educational material found within Without a doubt the new 5th Edition of Professional C is the leading resource for dedicated and knowledgeable professionals who desire to advance their skills and improve their abilities This book contains resources to help readers Maximize the capabilities of C with effective design solutions Master little known elements of the language and learn what to avoid Adopt new workarounds and testing debugging best practices Utilize real world program segments

in your own applications Notoriously complex and unforgiving C requires its practitioners to remain abreast of the latest developments and advancements Professional C 5th Edition ensures that its readers will do just that **C++ Templates** David Vandevoorde,Nicolai M. Josuttis,Douglas Gregor,2017-09-14 Templates are among the most powerful features of C but they remain misunderstood and underutilized even as the C language and development community have advanced In C Templates Second Edition three pioneering C experts show why when and how to use modern templates to build software that s cleaner faster more efficient and easier to maintain Now extensively updated for the C 11 C 14 and C 17 standards this new edition presents state of the art techniques for a wider spectrum of applications The authors provide authoritative explanations of all new language features that either improve templates or interact with them including variadic templates generic lambdas class template argument deduction compile time if forwarding references and user defined literals They also deeply delve into fundamental language concepts like value categories and fully cover all standard type traits The book starts with an insightful tutorial on basic concepts and relevant language features The remainder of the book serves as a comprehensive reference focusing first on language details and then on coding techniques advanced applications and sophisticated idioms Throughout examples clearly illustrate abstract concepts and demonstrate best practices for exploiting all that C templates can do Understand exactly how templates behave and avoid common pitfalls Use templates to write more efficient flexible and maintainable software Master today s most effective idioms and techniques Reuse source code without compromising performance or safety Benefit from utilities for generic programming in the C Standard Library Preview the upcoming concepts feature The companion website tmplbook com contains sample code and additional updates C/C++ Users Journal ,2005 *Generative Programming and Component Engineering* ,2003 Generative and Component-based Software Engineering ,2001 Technology of Object Oriented Languages and Systems ,1998 This text on the technology of object oriented languages and systems covers such topics as software development models language design and implementation concurrent objects object oriented applications distributed objects and agents and software development tools and environments **Exploring Extensibility and Performance in a Generic Programming Finite Element System** Michael Burton,2001 Dr. Dobb's Journal ,2009 **C++ Templates** David Vandevoorde,Nicolai M. Josuttis,2003 With the greatly increased use of templates there is a real need in the C community for this information This book is the next C classic acting as both a complete reference as well as a tutorial It emphasizes the practical use of templates and includes real world examples **Compiler Construction** ,2005 *C++11 for Programmers* Paul Deitel,Harvey M. Deitel,2013-03-21 In C 11 for Programmers the Deitels bring their proven Live Code approach to teaching today s powerful new version of the C language Like all Deitel Developer titles they teach the best way possible via hundreds of complete example C programs with thousands of lines of downloadable C source code Unlike other C 11 books this guide teaches robust best practice coding practices that fully support the CERT Coordination Center s authoritative secure coding

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