The Compiler Design Handbook Optimizations And Machine Code Generation

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Code You Can Believe In Cambridge University Press
Get to grips with various performance improvement techniques such as concurrency, lock-free programming, atomic operations, parallelism, and memory management Key Features Understand the limitations of modern CPUs and their performance impact Find out how you can avoid writing inefficient code and get the best optimizations from the compiler Learn the tradeoffs and costs of writing high-performance programs Book Description The great free lunch of "performance taking care of itself" is over. Until recently, programs got faster by themselves as CPUs were upgraded, but that doesn't happen anymore. The clock frequency of new processors has almost peaked. New architectures provide small improvements to existing programs, but this only helps slightly. Processors do get larger and more powerful, but most of this new power is consumed by the increased number of processing cores and other "extra" computing units. To write efficient software, you now have to know how to program by making good use of the available computing resources, and this book will teach you how to do that. The book covers all the major aspects of writing efficient programs, such as using CPU resources and memory efficiently, avoiding unnecessary computations, measuring performance, and how to put concurrency and multithreading to good use. You'll also learn about compiler optimizations and how to use the programming language (C++) more efficiently. Finally, you'll understand how design decisions impact performance. By the end of this book, you'll not only have enough knowledge of processors and compilers to write efficient programs, but you'll also be able to understand which techniques to use and what to measure while improving performance. At its core, this book is about learning how to learn. What you will learn Discover how to use the hardware computing resources in your programs effectively Understand the relationship between memory order and memory barriers Familiarize yourself with the performance implications of different data structures and organizations Assess the performance impact of concurrent memory accessed and how to minimize it Discover when to use and when not to use lock-free programming techniques Explore different ways to improve the effectiveness of compiler optimizations Design APIs for concurrent data structures and high-performance data structures to avoid inefficiencies Who this book is for This book is for experienced developers and programmers who work on performance-critical projects and want to learn different techniques to improve the performance of their code. Programmers who belong to algorithmic trading, gaming, bioinformatics, computational genomics, or computational fluid dynamics communities can learn various techniques from this book and apply them in their domain of work. Although this book uses the C++ language, the concepts demonstrated in the book can be easily transferred or applied to other compiled languages such as C, Java, Rust, Go, and more.
Compiler Design CRC Press
Performance Optimization of Numerically Intensive Codes offers a comprehensive, tutorial-style, hands-on, introductory and intermediate-level

treatment of all the essential ingredients for achieving high performance in numerical computations on modern computers. The authors explain computer architectures, data traffic and issues related to performance of serial and parallel code optimization exemplified by actual programs written for algorithms of wide interest. The unique hands-on style is achieved by extensive case studies using realistic computational problems. The performance gain obtained by applying the techniques described in this book can be very significant. The book bridges the gap between the literature in system architecture, the one in numerical methods and the occasional descriptions of optimization topics in computer vendors' literature. It also allows readers to better judge the suitability of certain computer architecture to their computational requirements. In contrast to standard textbooks on computer architecture and on programming techniques the book treats these topics together at the level necessary for writing high-performance programs. The book facilitates easy access to these topics for computational scientists and engineers mainly interested in practical issues related to efficient code development.

Building an Optimizing Compiler Packt Publishing Ltd

Compiler Design is a textbook for undergraduate and postgraduate students of engineering (computer science and information technology) and computer applications. It seeks to provide a thorough understanding of the design and implementation aspects of a compiler.

An advanced programmer's guide to efficient hardware utilization and compiler optimizations using C++ examples OUP India

Data flow analysis is used to discover information for a wide variety of useful applications, ranging from compiler optimizations to software engineering and verification. Modern compilers apply it to produce performance-maximizing code, and software engineers use it to re-engineer or reverse engineer programs and verify the integrity of their programs. Supplementary Online Materials to Strengthen Understanding Unlike most comparable books, many of which are limited to bit vector frameworks and classical constant propagation, Data Flow Analysis: Theory and Practice offers comprehensive coverage of both classical and contemporary data flow analysis. It prepares foundations useful for both researchers and students in the field by standardizing and unifying various existing research, concepts, and notations. It also presents mathematical foundations of data flow analysis and includes study of data flow analysis implantation through use of the GNU Compiler Collection (GCC). Divided into three parts, this unique text combines discussions of inter- and intraprocedural analysis and then describes implementation of a generic data flow analyzer (gdfa) for bit vector frameworks in GCC. Through the inclusion of case studies and examples to reinforce material, this text equips readers with a combination of mutually supportive theory and practice, and they will be able to access the author’s accompanying Web page. Here they can experiment with the analyses described in the book, and can make use of updated features, including: Slides used in the authors’ courses The source of the generic data flow analyzer (gdfa) An errata that features errors as they are discovered Additional updated relevant material discovered in the course of research

Principles, Techniques, and Tools Springer Science & Business Media

The widespread use of object-oriented languages and Internet security concerns are just the beginning. Add embedded systems, multiple memory banks, highly pipelined units operating in parallel, and a host of other advances and it becomes clear that current and future computer architectures pose immense challenges to compiler designers-challenges th

SSA-based Compiler Design Addison Wesley

Based on course-tested material, this rigorous yet accessible graduate textbook covers both fundamental and advanced optimization theory and algorithms. It covers a wide range of numerical methods and topics, including both gradient-based and gradient-free algorithms, multidisciplinary design optimization, and uncertainty, with instruction on how to determine which algorithm should be used for a given application. It also provides an overview of models and how to prepare them for use with numerical optimization, including derivative computation. Over 400 high-quality visualizations and numerous examples facilitate understanding of the theory, and practical tips address common issues encountered in practical engineering design optimization and how to address them. Numerous end-of-chapter homework problems, progressing in difficulty, help put knowledge into practice. Accompanied online by a solutions manual for instructors and source code for problems, this is ideal for a one- or two-semester graduate course on optimization in aerospace, civil, mechanical, electrical, and chemical engineering departments.

Introduction to Compiler Design Cambridge University Press

For real-time systems, the worst-case execution time (WCET) is the key objective to be considered. Traditionally, code for real-time systems is generated without taking this objective into account and the WCET is computed only after code generation. Worst-Case Execution Time Aware Compilation Techniques for Real-Time Systems presents the first comprehensive approach integrating WCET considerations into the code generation process. Based on the proposed reconciliation between a compiler and a timing analyzer, a wide range of novel optimization techniques is provided. Among others, the techniques cover source code and assembly level optimizations, exploit machine learning techniques and address the design of modern systems that have to meet multiple objectives. Using these optimizations, the WCET of real-time applications can be reduced by about 30% to 45% on the average. This opens opportunities for decreasing clock speeds, costs and energy consumption of embedded processors. The proposed techniques can be used for all types real-time systems, including automotive and avionics IT systems.

Delphi in a Nutshell Springer Science & Business Media

Obtain better system performance, lower energy consumption, and avoid hand-coding arithmetic functions with this concise guide to automated optimization techniques for hardware and software design. High-level compiler optimizations and high-speed architectures for implementing FIR filters are covered, which can improve performance in communications, signal processing, computer graphics, and cryptography. Clearly explained algorithms and illustrative examples throughout make it easy to understand the techniques and write software for their implementation. Background information on the synthesis of arithmetic expressions and computer arithmetic is also included, making the book ideal for newcomers to the subject. This is an invaluable resource for researchers, professionals, and graduate students working in system level design and automation, compilers, and VLSI CAD.

Modern Compiler Implementation in ML Morgan Kaufmann

A Practical Overview Of All Important Theoretical Topics Mixed With Many Examples. This Book Includes An Integrated Java Project That Leads To A Rich Understanding Of The Issues Involved In Compiler Design.

Compiler Design "O'Reilly Media, Inc."

Software -- Operating Systems.

Compiler Construction Pitman Publishing

A refreshing antidote to heavy theoretical tomes, this book is a concise, practical guide to modern compiler design and construction by an acknowledged master. Readers are taken step-by-step through each stage of compiler design, using the simple yet powerful method of recursive descent to create a compiler for Oberon-0, a subset of the author's Oberon language. A disk provided with the book gives full listings of the Oberon-0 compiler and associated tools. The hands-on, pragmatic approach makes the book equally attractive for project-oriented courses in compiler design and for software engineers wishing to develop their skills in system software.

Optimized C++ Morgan Kaufmann Publishers

This new, expanded textbook describes all phases of a modern compiler: lexical analysis, parsing, abstract syntax, semantic actions, intermediate representations, instruction selection via tree matching, dataflow analysis, graph-coloring register allocation, and runtime systems. It includes good coverage of current techniques in code generation and register allocation, as well as functional and object-oriented languages, that are missing from most books. In addition, more advanced chapters are now included so that it can be used as the basis for two-semester or graduate course. The most accepted and successful techniques are described in a concise way, rather than as an exhaustive catalog of every possible variant. Detailed descriptions of the interfaces between modules of a compiler are illustrated with actual C header files. The first part of the book, Fundamentals of Compilation, is suitable for a one-semester first course in compiler design. The second part, Advanced Topics, which includes the advanced chapters, covers the compilation of object-oriented and functional languages, garbage collection, loop optimizations, SSA form, loop scheduling, and optimization for cache-memory hierarchies.

Analysis and Transformation Addison-Wesley Professional

This new, expanded textbook describes all phases of a modern compiler: lexical analysis, parsing, abstract syntax, semantic actions, intermediate representations, instruction selection via tree matching, dataflow analysis, graph-coloring register allocation, and runtime systems. It includes good coverage of current techniques in code generation and register allocation, as well as functional and object-oriented languages, that are missing from most books. In addition, more advanced chapters are now included so that it can be used as the basis for a two-semester or graduate course. The most accepted and successful techniques are described in a concise way, rather than as an exhaustive catalog of every possible variant. Detailed descriptions of the interfaces between modules of a compiler are illustrated with actual C header files. The first part of the book, Fundamentals of Compilation, is suitable for a one-semester first course in compiler design. The second part, Advanced Topics, which includes the advanced chapters, covers the compilation of object-oriented and functional languages, garbage collection, loop optimizations, SSA form, loop scheduling, and optimization for cache-memory hierarchies.

The Art of Compiler Design Digital Press

Coding and testing are often considered separate areas of expertise. In this comprehensive guide, author and Java expert Scott Oaks takes the approach that anyone who works with Java should be equally adept at understanding how code behaves in the JVM, as well as the tunings likely to help its performance. You’ll gain in-depth knowledge of Java application performance, using the Java Virtual Machine (JVM) and the Java platform, including the language and API. Developers and performance engineers alike will learn a variety of features, tools, and processes for improving the way Java 7 and 8 applications perform. Apply four principles for obtaining the best results from performance testing Use JDK tools to collect data on how a Java application is performing Understand the advantages and disadvantages of using a JIT compiler Tune JVM garbage collectors to affect programs as little as possible Use techniques to manage heap memory and JVM native memory Maximize Java threading and synchronization performance features Tackle performance issues in Java EE and Java SE APIs Improve Java-driven database application performance

Proven Techniques for Heightened Performance "O'Reilly Media, Inc."

While compilers for high-level programming languages are large complex software systems, they have particular characteristics that differentiate them from other software systems. Their functionality is almost completely well-defined - ideally there exist complete precise descriptions of the source and target languages. Additional descriptions of the interfaces to the operating system, programming system and programming environment, and to other compilers and libraries are often available. The book deals with the optimization phase of compilers. In this phase, programs are transformed in order to increase their efficiency. To preserve the semantics of the programs in these transformations, the compiler has to meet the associated applicability conditions. These are checked using static analysis of the programs. In this book the authors systematically describe the analysis and transformation of imperative and functional programs. In addition to a detailed description of important efficiency-improving transformations, the book offers a concise introduction to the necessary concepts and methods, namely to operational semantics, lattices, and fixed-point algorithms. This book is intended for students of computer science. The book is supported throughout with examples, exercises and program fragments.

Real World Haskell Springer

Today’s embedded devices and sensor networks are becoming more and more sophisticated, requiring more efficient and highly flexible compilers. Engineers are discovering that many of the compilers in use today are ill-suited to meet the demands of more advanced computer architectures. Updated to include the latest techniques, The Compiler Design Handbook, Second Edition offers a unique opportunity for designers and researchers to update their knowledge, refine their skills, and prepare for emerging innovations. The completely revised handbook includes 14 new chapters addressing topics such as worst case execution time estimation, garbage collection, and energy aware compilation. The editors take special care to consider the growing proliferation of embedded devices, as well as the need for efficient techniques to debug faulty code. New contributors provide additional insight to chapters on register allocation, software pipelining, instruction scheduling, and type systems. Written by top researchers and designers from around the world, The Compiler Design Handbook, Second Edition gives designers the opportunity to incorporate and develop

innovative techniques for optimization and code generation.

Arithmetic Optimization Techniques for Hardware and Software Design Cambridge University Press

"The bulk of the book is a complete ordered reference to the Delphi language set. Each reference item includes: the syntax, using standard code conventions; a description; a list of arguments, if any, accepted by the function or procedure; tips and tricks of usage - practical information on using the language feature in real programs; a brief example; and a cross-reference to related keywords."--Jacket.

Engineering Design Optimization CRC Press

Maintaining a balance between a theoretical and practical approach to this important subject, Elements of Compiler Design serves as an introduction to compiler writing for undergraduate students. From a theoretical viewpoint, it introduces rudimental models, such as automata and grammars, that underlie compilation and its essential phases. Based on these models, the author details the concepts, methods, and techniques employed in compiler design in a clear and easy-to-follow way. From a practical point of view, the book describes how compilation techniques are implemented. In fact, throughout the text, a case study illustrates the design of a new programming language and the construction of its compiler. While discussing various compilation techniques, the author demonstrates their implementation through this case study. In addition, the book presents many detailed examples and computer programs to emphasize the applications of the compiler algorithms. After studying this self-contained textbook, students should understand the compilation process, be able to write a simple real compiler, and easily follow advanced books on the subject.

The Compiler Design Handbook "O'Reilly Media, Inc."

A compiler translates a program written in a high level language into a program written in a lower level language. For students of computer science, building a compiler from scratch is a rite of passage: a challenging and fun project that offers insight into many different aspects of computer science, some deeply theoretical, and others highly practical. This book offers a one semester introduction into compiler construction, enabling the reader to build a simple compiler that accepts a C-like language and translates it into working X86 or ARM assembly language. It is most suitable for undergraduate students who have some experience programming in C, and have taken courses in data structures and computer architecture.

Second Edition Springer

The second edition of this textbook has been fully revised and adds material about loop optimisation, function call optimisation and dataflow analysis. It presents techniques for making realistic compilers for simple programming languages, using techniques that are close to those used in "real" compilers, albeit in places slightly simplified for presentation purposes. All phases required for translating a high-level language to symbolic machine language are covered, including lexing, parsing, type checking, intermediate-code generation, machine-code generation, register allocation and optimisation, interpretation is covered briefly. Aiming to be neutral with respect to implementation languages, algorithms are presented in pseudo-code rather than in any specific programming language, but suggestions are in many cases given for how these can be realised in different language flavours. Introduction to Compiler Design is intended for an introductory course in compiler design, suitable for both undergraduate and graduate courses depending on which chapters are used.