TEXTS AND MONOGRAPHS IN COMPUTER SCIENCE

# THE DESIGN OF WELL-STRUCTURED AND CORRECT PROGRAMS

Suad Alagić Michael A. Arbib

Springer-Verlag

# **The Design Of Wellstructured And Correct Programs**

**Andrei Sorin** 

# The Design Of Wellstructured And Correct Programs:

The Design of Well-structured and Correct Programs Suad Alagić, Michael A. Arbib, 1978 Examples given written in The Design of Well-Structured and Correct Programs Suad Alagic, Michael A. Arbib, 2013-11-11 The major Pascal goal of this book is to present the techniques of top down program design and verification of program correctness hand in hand It thus aims to give readers a new way of looking at algorithms and their design synthesizing ten years of research in the process It provides many examples of program and proof development with the aid of a formal and informal treatment of Hoare's method of invariants Modem widely accepted control structures and data structures are explained in detail together with their formal definitions as a basis for their use in the design of correct algorithms. We provide and apply proof rules for a wide range of program structures including conditionals loops procedures and recur sion We analyze situations in which the restricted use of gotos can be justified providing a new approach to proof rules for such situations We study several important techniques of data structuring including arrays files records and linked structures The secondary goal of this book is to teach the reader how to use the programming language Pascal This is the first text to teach Pascal pro gramming in a fashion which not only includes advanced algorithms which operate on advanced data structures but also provides the full axiomatic definition of Pascal due to Wirth and Hoare Our approach to the language is very different from that of a conventional programming text **Program Verification** Timothy T.R. Colburn, J.H. Fetzer, R.L. Rankin, 2012-12-06 Among the most important problems confronting computer science is that of developing a paradigm appropriate to the discipline Proponents of formal methods such as John McCarthy C A R Hoare and Edgar Dijkstra have advanced the position that computing is a mathematical activity and that computer science should model itself after mathematics Opponents of formal methods by contrast suggest that programming is the activity which is fundamental to computer science and that there are important differences that distinguish it from mathematics which therefore cannot provide a suitable paradigm Disagreement over the place of formal methods in computer science has recently arisen in the form of renewed interest in the nature and capacity of program verification as a method for establishing the reliability of software systems A paper that appeared in Communications of the ACM entitled Program Verification The Very Idea by James H Fetzer triggered an extended debate that has been discussed in several journals and that has endured for several years engaging the interest of computer scientists both theoretical and applied and of other thinkers from a wide range of backgrounds who want to understand computer science as a domain of inquiry The editors of this collection have brought together many of the most interesting and important studies that contribute to answering questions about the nature and the limits of computer science These include early papers advocating the mathematical paradigm by McCarthy Naur R Floyd and Hoare in Part I others that elaborate the paradigm by Hoare Meyer Naur and Scherlis and Scott in Part II challenges limits and alternatives explored by C Floyd Smith Blum and Naur in Part III and recent work focusing on formal verification by DeMillo Lipton and Perlis Fetzer

Cohn and Colburn in Part IV It provides essential resources for further study This volume will appeal to scientists philosophers and laypersons who want to understand the theoretical foundations of computer science and be appropriately positioned to evaluate the scope and limits of the discipline

Program Verification Using Ada McGettrick, 1982-07-29

**Recursion Via Pascal** Jeffrey Soden Rohl, 1984-07-26 This book is devoted to recursion in programming the technique by which the solution to a problem is expressed partly in terms of the solution to a simpler version of the same problem Ultimately the solution to the simplest version must be given explicitly In functional programming recursion has received its full due since it is quite often the only repetitive construct However the programming language used here is Pascal and the examples have been chosen accordingly It makes an interesting contrast with the use of recursion in functional and logic programming The early chapters consider simple linear recursion using examples such as finding the highest common factor of a pair of numbers and processing linked lists Subsequent chapters move up through binary recursion with examples which include the Towers of Hanoi problem and symbolic differentiation to general recursion The book contains well over 100 The ^ASecond Age of Computer Science Subrata Dasgupta,2018-05-01 Between the genesis of computer science in the 1960s and the advent of the World Wide Web around 1990 computer science evolved in significant ways The author has termed this period the second age of computer science This book describes its evolution in the form of several interconnected parallel histories Introduction to Programming and Debugging in MTS. Kalle Nemvalts, 1986 Practical Handbook for Software Development N. D. Birrell, Martyn A. Ould, M. A. Ould, 1988-02-11 The designer of a software system like the architect of a building needs to be aware of the construction techniques available and to choose the ones that are the most appropriate This book provides the implementer of software systems with a guide to 25 different techniques for the complete development processes from system definition through design and into production The techniques are described against a common background of the traditional development path its activities and deliverable items In addition the concepts of metrics and indicators are introduced as tools for both technical and managerial monitoring and control of progress and quality The book is intended to widen the mental toolkit of system developers and their managers and will also introduce students of computer science to the practical side of software development With its wide ranging treatment of the techniques available and the practical guidance it offers it will prove an important and valuable work Algebraic **Approaches to Program Semantics** Ernest G. Manes, Michael A. Arbib, 2012-12-06 In the 1930s mathematical logicians studied the notion of effective comput ability using such notions as recursive functions A calculus and Turing machines The 1940s saw the construction of the first electronic computers and the next 20 years saw the evolution of higher level programming languages in which programs could be written in a convenient fashion independent thanks to compilers and interpreters of the architecture of any specific machine The development of such languages led in turn to the general analysis of questions of syntax structuring strings of symbols which could count as legal programs and semantics

determining the meaning of a program for example as the function it computes in transforming input data to output results An important approach to semantics pioneered by Floyd Hoare and Wirth is called assertion semantics given a specification of which assertions preconditions on input data should guarantee that the results satisfy desired assertions postconditions on output data one seeks a logical proof that the program satisfies its specification An alternative approach pioneered by Scott and Strachey is called denotational semantics it offers algebraic techniques for characterizing the denotation of i e the function computed by a program the properties of the program can then be checked by direct comparison of the denotation with the specification This book is an introduction to denotational semantics More specifically we introduce the reader to two approaches to denotational semantics the order semantics of Scott and Strachey and our own partially additive semantics

Advances in Computers ,1989-07-17 Advances in Computers **First-Order Programming Theories** Tamas Gergely, Laszlo Ury, 2012-12-06 This work presents a purely classical first order logical approach to the field of study in theoretical computer science sometimes referred to as the theory of programs or programming theory. This field essentially attempts to provide a precise mathematical basis for the common activities involved in reasoning about computer programs and programming languages and it also attempts to find practical applications in the areas of program specification verification and programming language design Many different approaches with different mathematical frameworks have been proposed as a basis for programming theory. They differ in the mathe matical machinery they use to define and investigate programs and program properties and they also differ in the concepts they deal with to understand the programming paradigm Different approaches use different tools and viewpoints to characterize the data environment of programs Most of the approaches are related to mathe matical logic and they provide their own logic These logics however are very eclectic since they use special entities to reflect a special world of programs and also they are usually incomparable with each other This Babel's mess irritated us and we decided to peel off the eclectic components and try to answer all the Software and Mind Andrei Sorin, 2013-01-01 Addressing general readers as questions by using classical first order logic well as software practitioners Software and Mind discusses the fallacies of the mechanistic ideology and the degradation of minds caused by these fallacies Mechanism holds that every aspect of the world can be represented as a simple hierarchical structure of entities But while useful in fields like mathematics and manufacturing this idea is generally worthless because most aspects of the world are too complex to be reduced to simple hierarchical structures Our software related affairs in particular cannot be represented in this fashion And yet all programming theories and development systems and all software applications attempt to reduce real world problems to neat hierarchical structures of data operations and features Using Karl Popper's famous principles of demarcation between science and pseudoscience the book shows that the mechanistic ideology has turned most of our software related activities into pseudoscientific pursuits Using mechanism as warrant the software elites are promoting invalid even fraudulent software notions. They force us to depend on generic inferior systems instead of

allowing us to develop software skills and to create our own systems Software mechanism emulates the methods of manufacturing and thereby restricts us to high levels of abstraction and simple isolated structures The benefits of software however can be attained only if we start with low level elements and learn to create complex interacting structures Software the book argues is a non mechanistic phenomenon So it is akin to language not to physical objects Like language it permits us to mirror the world in our minds and to communicate with it Moreover we increasingly depend on software in everything we do in the same way that we depend on language Thus being restricted to mechanistic software is like thinking and communicating while being restricted to some ready made sentences supplied by an elite Ultimately by impoverishing software our elites are achieving what the totalitarian elite described by George Orwell in Nineteen Eighty Four achieves by impoverishing language they are degrading our minds Microcomputer Kenneth L. Bowles, 2013-12-11 This book is designed both for introductory courses in computer problem solving at the freshman and sophomore college level and for individual self study. An earlier version of the book has been used seven times for teaching large introductory classes at University of California San Diego UCSD This preface is intended for the instructor or for anyone sophisticated enough in contemporary computing practice to be able to advise the prospective student The amount of material presented has been completed by about 55 percent of all students taking the course where UCSD schedules 10 weeks of classes in a quarter We have taught the course using Keller's Personalized System of Instruction PSI though the organization of the book does not require that plan to be used PSI methods allow slightly more material to be absorbed by the students than is the case with the traditional lecture recitation presentation PSI allows grading according to the number of chapter units completed Virtually all students who pass the course at UCSD do complete the first ten essential chapters and the Exercises associated with them For a conventional presentation under the semester system the 15 chapters should present an appropriate amount of material For a conventional course under the quarter system one might not expect to complete more than the first 12 **Elementary Logic** Robert Lover, 2008-10-26 The ability to reason correctly is chapters except on an extra credit basis critical to most aspects of computer science and to software development in particular This book teaches readers how to better reason about software development to communicate reasoning to distinguish between good and bad reasoning and to read professional literature that presumes knowledge of elementary logic The reader s knowledge and understanding can be assessed through numerous examples and exercises This book provides a reader friendly foundation to logic and offers valuable insight into the topic thereby serving as a helpful reference for practitioners as well as students studying software Computers and the Cybernetic Society Michael A. Arbib, 2014-05-10 Computers and the Cybernetic Society development Second Edition examines the impact of computers on the cybernetic society and covers topics such as expert systems management applications and office automation The idea of a computer program is considered along with data banks and the movement and storage of information Advances in computer technology are also discussed Comprised of nine chapters this

book begins with an assessment of the interaction between computer developments and social pressures The interplay between the exciting possibilities of computer networking and the social implications of computer technology is highlighted by focusing on planning networks and public information networks The next two chapters provide a basic understanding of computers and programming by describing key concepts such as computer graphics networks microcomputers and program design The next five chapters give a comprehensive overview of the impact of computers on the cybernetic society The final chapter explains how hardware works and describes the circuitry that computers use to execute a program at the level of machine language instructions This monograph is intended for both students and instructors in the fields of computer science and cybernetics Automata and Languages Alexander Meduna, 2012-12-06 Automata and Languages presents a step by step development of the theory of automata languages and computation Intended to be used as the basis of an introductory course to this theory at both junior and senior levels the text is organized in such a way as to allow the design of various courses based on selected material Areas featured in the book include basic models of computation formal languages and their properties computability decidability and complexity a discussion of the modern trends in the theory of automata and formal languages design of programming languages including the development of a new programming language compiler design including the construction of a complete compiler Alexander Meduna uses clear definitions easy to follow proofs and helpful examples to make formerly obscure concepts easy to understand He also includes challenging exercises and programming projects to enhance the reader's comprehension and to put the theory firmly into a real world context he presents lots of realistic illustrations and applications in practical computer science *Grammars with Context Conditions* and Their Applications Alexander Meduna, Martin Švec, 2005-08-08 The essential guide to grammars with context conditions This advanced computer science book systematically and compactly summarizes the current knowledge about grammars with contextconditions an important area of formal language theory According to the types of context conditions this self contained reference classifies them into grammars with context conditions placed on the domains of grammatical derivations the use of grammatical productions and the neighborhood of the rewritten symbols Thefocus is on grammatical generative power important properties simplification reduction implementation and applications most of which are related to microbiology The text features Up to date coverage of grammatical concepts based on contextconditions Self contained explanations without assumption of any previousknowledge Clear definitions and exact proofs preceded by intuitive explanations Numerous easy to implement grammatical transformations Realistic applications Relation to mathematics linguistics and biology Additional material and information about the book available onaccompanying Web site see preface for details Practitioners and advanced students in theoretical computer scienceand related areas including mathematics linguistics andmolecular biology will find Grammars with Context Conditions and Their Applications an essential reference for this cutting edgearea of formal The Origin of Concurrent Programming Per Brinch Hansen, 2013-06-29 One cannot build or language theory

understand a modern operating system unless one knows the principles of concurrent programming This volume is a collection of 19 original papers on the invention and origins of concurrent programming illustrating the major breakthroughs in the field from the mid 1960s to the late 1970s All of them are written by the pioneers in concurrent programming including Brinch Hansen himself and have introductions added that summarize the papers and put them in perspective This anthology is an essential reference for professional programmers researchers and students of electrical engineering and computer science A familiarity with operating system principles is assumed Programming in the 1990s Edward Cohen, 2012-12-06 Programming is a fascinating and challenging subject Unfortunately it is rarely presented as such Most often it is taught by induction features of some famous programming languages are given operational meaning e g a loop goes round and round a number of examples are shown and by induction we are asked to develop other programs often radically different from the ones we ve seen Basically we are taught to guess our programs and then to patch up our guesses Our errors are given the cute name of bugs Fixing them becomes puzzle solving as does finding tricks that exploit or avoid poorly designed features of the programming language The entire process is time consuming and expensive And even so we are never quite sure if our programs really work in all cases When approached in this way programming is indeed a dull activity There is however another approach to programming an approach in which programs can be developed reliably with attention to the real issues It is a practical approach based on methodically developing programs from their specifications Besides being practical it is exciting Many programs can be developed with relative ease Problems which once were difficult can now be solved by beginners Elegant solutions bring great satisfaction This is our subject We are interested in making programming an exciting topic The Formal Semantics of Programming Languages Glynn Winskel, 1993-02-05 The Formal Semantics of Programming Languages provides the basic mathematical techniques necessary for those who are beginning a study of the semantics and logics of programming languages These techniques will allow students to invent formalize and justify rules with which to reason about a variety of programming languages Although the treatment is elementary several of the topics covered are drawn from recent research including the vital area of concurency The book contains many exercises ranging from simple to miniprojects Starting with basic set theory structural operational semantics is introduced as a way to define the meaning of programming languages along with associated proof techniques Denotational and axiomatic semantics are illustrated on a simple language of while programs and fall proofs are given of the equivalence of the operational and denotational semantics and soundness and relative completeness of the axiomatic semantics A proof of Godel s incompleteness theorem which emphasizes the impossibility of achieving a fully complete axiomatic semantics is included It is supported by an appendix providing an introduction to the theory of computability based on while programs Following a presentation of domain theory the semantics and methods of proof for several functional languages are treated The simplest language is that of recursion equations with both call by value and call by name evaluation This work is extended to lan

guages with higher and recursive types including a treatment of the eager and lazy lambda calculi Throughout the relationship between denotational and operational semantics is stressed and the proofs of the correspondence between the operation and denotational semantics are provided The treatment of recursive types one of the more advanced parts of the book relies on the use of information systems to represent domains The book concludes with a chapter on parallel programming languages accompanied by a discussion of methods for specifying and verifying nondeterministic and parallel programs

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