Homework Assignment 1 Search Algorithms

The Portuguese Association for Arti cial Intelligence (APPIA) has been re- larly organising the Portuguese Conference on Arti cial Intelligence (EPIA). This ninth conference follows previous ones held in Porto (1985), Lisboa (1986), Braga (1987), Lisboa (1989), Albufeira (1991), Porto (1993), Funchal (1995) and Coimbra (1997). Starting in 1989, the conferences have been held biennially (alternating with an APPIA Advanced School on Arti cial Intelligence) and become truly international: English has been adopted as the o cial language and the proceedings are published in Springer's LNAI series. The conference has recon rmed its high international standard this year, largely due to its programme committee, composed of distinguished researchers in a variety of specialities in Arti cial Intelligence, half of them from Portuguese universities. This has attracted a signi cant international interest, well expressed by the number of papers submitted (66), from 17 di erent countries, 29 of which are by Portuguese researchers. From the 66 papers submitted, about one third of them (23) were selected for oral presentation and have been published in this volume. The review process enabled the selection of high quality papers, each paper being reviewed by two or three reviewers, either from the programme committee or by their appointment. We would like to thank all of the reviewers for their excellent and hard work.

The Symposium on Theoretical Aspects of Computer Science (STACS) is alt- nately held in France and in Germany. The conference of March 25-27, 2004 at the Corum, Montpellier was the twenty-?rst in this series. Previous meetings took place in Paris (1984), Saarbruc ? ken (1985), Orsay (1986), Passau (1987), Bordeaux (1988), Paderborn (1989), Rouen (1990), Hamburg (1991), Cachan (1992),Wurzburg ? (1993),Caen(1994),Munc ? hen(1995),Grenoble(1996),Lub ? eck (1997), Paris (1998), Trier (1999), Lille (2000), Dresden (2001), Antibes (2002), and Berlin (2003). The symposium looks back at a remarkable tradition of over 20 years. The interest in STACS has been increasing continuously during recent years and has turned it into one of the most signi?cant conferences in theoretical computer science. The STACS 2004 call for papers led to more than 200 submissions from all over the world. Thereviewingprocesswasextremelyhard:morethan800reviewsweredone. We would like to thank the program committee and all external referees for the valuable work they put into the reviewing process of this conference. We had a two-day meeting for the program committee in Montpellier during November 21-22, 2003. Just 54 papers (i.e., 27% of the submissions) could be accepted, as we wanted to keep the conference in its standard format with only two parallel sessions. This strict selection guaranteed the very high scienti?c quality of the conference.

One of Springer's renowned Major Reference Works, this awesome achievement provides a comprehensive set of solutions to important algorithmic problems for students and researchers interested in quickly locating useful information. This first edition of the reference focuses on high-impact solutions from the most recent decade, while later editions will widen the scope of the work. All entries have been written by experts, while links to Internet sites that outline their research work are provided. The entries have all been peer-reviewed. This defining reference is published both in print and on line.

The field of bioinformatics and computational biology arose due to the need to apply techniques from computer science, statistics, informatics, and applied mathematics to solve biological problems. Scientists have been trying to study biology at a molecular level using techniques derived from biochemistry, biophysics, and genetics. Progress has greatly accelerated with the discovery of fast and inexpensive automated DNA sequencing techniques. As the genomes of more and more organisms are sequenced and assembled, scientists are discovering many useful facts by tracing the evolution of organisms by measuring changes in their DNA, rather than through physical characteristics alone. This has led to rapid growth in the related fields of phylogenetics, the study of evolutionary relatedness

among various groups of organisms, and comparative genomics, the study of the correspondence between genes and other genomic features in different organisms. Comparing the genomes of organisms has allowed researchers to better understand the features and functions of DNA in individual organisms, as well as provide insights into how organisms evolve over time. The first four chapters of Advances in Computers focus on algorithms for comparing the genomes of different organisms. Possible concrete applications include identifying the basis for genetic diseases and tracking the development and spread of different forms of Avian flu. As researchers begin to better understand the function of DNA, attention has begun shifting towards the actual proteins produced by DNA. The final two chapters explore proteomic techniques for analyzing proteins directly to identify their presence and understand their physical structure. Written by active PhD researchers in computational biology and bioinformatics

Progress in Artificial Intelligence11th Protuguese Conference on Artificial Intelligence, EPIA 2003, Beja, Portugal, December 4-7, 2003, ProceedingsSpringer

Device testing represents the single largest manufacturing expense in the semiconductor industry, costing over $40 billion a year. The most comprehensive and wide ranging book of its kind, Testing of Digital Systems covers everything you need to know about this vitally important subject. Starting right from the basics, the authors take the reader through automatic test pattern generation, design for testability and built-in self-test of digital circuits before moving on to more advanced topics such as IDDQ testing, functional testing, delay fault testing, memory testing, and fault diagnosis. The book includes detailed treatment of the latest techniques including test generation for various fault models, discussion of testing techniques at different levels of integrated circuit hierarchy and a chapter on system-on-a-chip test synthesis. Written for students and engineers, it is both an excellent senior/graduate level textbook and a valuable reference.

This is the first book presenting a broad overview of parallelism in constraint-based reasoning formalisms. In recent years, an increasing number of contributions have been made on scaling constraint reasoning thanks to parallel architectures. The goal in this book is to overview these achievements in a concise way, assuming the reader is familiar with the classical, sequential background. It presents work demonstrating the use of multiple resources from single machine multi-core and GPU-based computations to very large scale distributed execution platforms up to 80,000 processing units. The contributions in the book cover the most important and recent contributions in parallel propositional satisfiability (SAT), maximum satisfiability (MaxSAT), quantified Boolean formulas (QBF), satisfiability modulo theory (SMT), theorem proving (TP), answer set programming (ASP), mixed integer linear programming (MILP), constraint programming (CP), stochastic local search (SLS), optimal path finding with A*, model checking for linear-time temporal logic (MC/LTL), binary decision diagrams (BDD), and model-based diagnosis (MBD). The book is suitable for researchers, graduate students, advanced undergraduates, and practitioners who wish to learn about the state of the art in parallel constraint reasoning.

This book constitutes the thoroughly refereed and extended post-proceedings of the Joint ERCIM/CoLogNet International Workshop on Constraint Solving and Constraint Logic Programming, CSCLP 2005. The 12 revised full papers presented were carefully reviewed and selected for inclusion in the book. The papers are organized in topical sections on global constraints, search and heuristics, language and implementation issues, and modeling.

This book constitutes the proceedings of the 24th International Conference on Theory and Applications of Satisfiability Testing, SAT 2021, which took place in Barcelona, Spain, in July 2021. The 37 full papers presented in this volume were carefully reviewed and selected from 73 submissions. They deal with theory and applications of the propositional satisfiability problem, broadly construed. Aside from plain propositional satisfiability, the scope of the

meeting includes Boolean optimization, including MaxSAT and pseudo-Boolean (PB) constraints, quantified Boolean formulas (QBF), satisfiability modulo theories (SMT), and constraint programming (CP) for problems with clear connections to Boolean reasoning. This book constitutes the thoroughly refereed post-proceedings of the Joint ERCIM/CologNet International Workshop on Constraint Solving and Constraint Logic Programming, held in Cork, Ireland in June 2002. The 14 revised full papers presented were carefully selected for inclusion in the book during two rounds of reviewing and revision. Among the topics addressed are verification and debugging of constraint logic programs, modeling and solving CSPs, explanation generation, inference and inconsistency processing, SAT and 0/1 encodings of CSPs, soft constraints and constraint relaxation, real-world applications, and distributed constraint solving.

In the summer of 1956, John McCarthy organized the famous Dartmouth Conference which is now commonly viewed as the founding event for the field of Artificial Intelligence. During the last 50 years, AI has seen a tremendous development and is now a well-established scientific discipline all over the world. Also in Europe AI is in excellent shape, as witnessed by the large number of high quality papers in this publication. In comparison with ECAI 2004, there's a strong increase in the relative number of submissions from Distributed AI / Agents and Cognitive Modelling. Knowledge Representation & Reasoning is traditionally strong in Europe and remains the biggest area of ECAI-06. One reason the figures for Case-Based Reasoning are rather low is that much of the high quality work in this area has found its way into prestigious applications and is thus represented under the heading of PAIS.

The goal of this book is to present the latest applications of machine learning, which mainly include: speech recognition, traffic and fault classification, surface quality prediction in laser machining, network security and bioinformatics, enterprise credit risk evaluation, and so on. This book will be of interest to industrial engineers and scientists as well as academics who wish to pursue machine learning. The book is intended for both graduate and postgraduate students in fields such as computer science, cybernetics, system sciences, engineering, statistics, and social sciences, and as a reference for software professionals and practitioners. The wide scope of the book provides them with a good introduction to many application researches of machine learning, and it is also the source of useful bibliographical information. This book presents state-of-the-art technical contributions based around one of the most successful evolutionary optimization algorithms published to date: Harmony Search. Contributions span from novel technical derivations of this algorithm to applications in the broad fields of civil engineering, energy, transportation & mobility and health, among many others and focus not only on its cross-domain applicability, but also on its core evolutionary operators, including elements inspired from other meta-heuristics. The global scientific community is witnessing an upsurge in groundbreaking, new advances in all areas of computational intelligence, with a particular flurry of research focusing on evolutionary computation and bio-inspired optimization. Observed processes in nature and sociology have provided the basis for innovative algorithmic developments aimed at leveraging the inherent capability to adapt characterized by various animals, including ants, fireflies, wolves and humans. However, it is the behavioral patterns observed in music composition that motivated the advent of the Harmony Search algorithm, a meta-heuristic optimization algorithm that over the last decade has been shown to dominate other solvers in a plethora of application scenarios. The book consists of a selection of the best contributions presented at ICHSA, a major biannual event where leading global experts on meta-heuristic optimization present their latest findings and discuss the past, present, and future of the exciting field of Harmony Search optimization. It provides a valuable reference resource for researchers working in the field of optimization meta-heuristics, and a solid technical base for frontline investigations around this algorithm.

This book constitutes the refereed proceedings of the First International Conference on Integration of AI and OR Techniques in Constraint Programming for Combinatorial Optimization Problems, CPAIOR 2004, held in Nice, France in April 2004. The 23 revised full papers and 7 revised short papers presented together with an invited talk were carefully reviewed and selected from 56 submissions. Methodological and foundational issues from AI, OR, and algorithmics are presented as well as applications to the solution of combinatorial optimization problems in various fields via constraint programming.

Stochastic local search (SLS) algorithms are established tools for the solution of computationally hard problems arising in computer science, business adm- istration, engineering, biology, and various other disciplines. To a large extent, their success is due to their conceptual simplicity, broad applicability and high performance for many important problems studied in academia and enco- tered in real-world applications. SLS methods include a wide spectrum of te- niques, ranging from constructive search procedures and iterative improvement algorithms to more complex SLS methods, such as ant colony optimization, evolutionary computation, iterated local search, memetic algorithms, simulated annealing, tabu search, and variable neighborhood search. Historically, the development of e?ective SLS algorithms has been guided to a large extent by experience and intuition. In recent years, it has become - creasingly evident that success with SLS algorithms depends not merely on the adoption and e?cient implementation of the most appropriate SLS technique for a given problem, but also on the mastery of a more complex algorithm - gineering process. Challenges in SLS algorithm development arise partly from the complexity of the problems being tackled and in part from the many - grees of freedom researchers and practitioners encounter when developing SLS algorithms. Crucial aspects in the SLS algorithm development comprise al- rithm design, empirical analysis techniques, problem-speci?c background, and background knowledge in several key disciplines and areas, including computer science, operations research, arti?cial intelligence, and statistics.

When we set about organizing EPIA 2003 in Porto during the APPIA meeting at the previous edition of the conference, EPIA 2001, it was decided that it would be organized by Fernando Moura Pires (Fajþ e) and myself. We chose Beja as the venue to host the conference, as it provided a good support infrastructure and Fernando had a good working relationship with several people at the Beja Polytechnic Institute. Shortly thereafter, Fernando came to know that he was ailing from a disease thatwastotakehislifeinMay2003.

Aswithmanyotherprojectsinwhichhegot involved, Fernando clung to the organization of this conference with dedication and perseverance, even while knowing that he might not see the results of his work. EPIA 2003 is a tribute to his work. Taking up on the successful experience gained from EPIA 2001, we decided to structure EPIA 2003 as a set of?ve distinct workshops, roughly re?ecting the panorama of AI research in Portugal. Special thanks are due to the organizers of each workshop, for the quality and timeliness of the work they carried out. The conference was all the more interesting because of the eight invited p- sentations and tutorials, by Alexander Bockmayr, Amþ?lcar Cardoso, Dario F- reano, HaroldBoley, PedroDomingos, PieterAdriaans, VeronicaDahlandVitor Santos Costa. There are short one-page abstracts included in these proceedings for some of these presentations.

In recent years the Internet has become a source of data and information of indisputable importance and has immensely gained in acceptance and popularity. The World Wide Web (WWW or Web, for short), frequently named "the nervous system of the infor- tion society," offers numerous valuable services leaving no doubt about the signi?cance of the Web in our daily activities at work and at home. Consequently, we have a clear aspiration to meet the obvious need for effective use of its potential by making - provements in both the methods and the technology applied. Among the new research directions observable in Web-related applications, intelligent methods from within the broadly perceived topic of soft computing

occupy an important place. AWIC, the "Atlantic Web Intelligence Conferences" are intended to be a forum for exchange of new ideas and novel practical solutions in this new and exciting ?eld. The conference was born as an initiative of the WIC-Poland and the WIC-Spain Research Centres, both belonging to the Web Intelligence Consortium – WIC (http://wi-consortium.org/). So far, three AWIC conferences have been held: in Madrid, Spain (2003), in Cancun, Mexico (2004), and in ?ódz, ? Poland (2005).

Agent technology is evolving as a leading field of research connected to diverse areas such as A.I., E-commerce, robotics and information retrieval. Agents systems use reasoning and constraint-based reasoning that has a wide potential for representing multiple types of problems. A fundamental building block within all these areas is the ability to perform search and an inherent part of all agents must therefore relate to distributed and cooperative methods of search. This book presents a comprehensive discussion on the field of distributed constraints, its algorithms and its active research areas. It introduces distributed constraint satisfaction and optimization problems and proceeds to present a complete state-of-the-art in DisCSP & DisCOP research. The presentation assumes no prior knowledge of constraints or distributed constraints. Features and topics: • Introduces in great detail search algorithms for DisCSPs and DisCOPs • Presents a comprehensive study of distributed performance measures for all algorithms, allowing an extensive experimental evaluation to be constructed • Addresses potential problems following current research on DisCSPs and DisCOPs • Discusses the impact of communication quality on distributed search (for example message delays) • Describes the most significant recent research in the field of distributed constraints satisfaction and optimization, including its difficulties This exposition of the many elements of distributed search algorithms for DisCSPs and DisCOPs will be a research asset and an invaluable read for researchers and graduate students who focus on distributed CSPs and COPs. In addition, the book's comprehensiveness and style make it an ideal tool for a graduate course on distributed search in AI. Professor Amnon Meisels has an active research group who have worked in distributed constraints for a number of years and has published extensively in the field. He is a member of the Department of Computer Science at Ben-Gurion University, Beer-Sheva, Israel.

This book constitutes the refereed conference proceedings of the 20th International Conference on Principles and Practice of Constraint Programming, CP 2014, held in Lyon, France, in September 2014. The 65 revised papers presented together with 4 invited talks were carefully selected from 108 submissions. The scope of CP 2014 includes all aspects of computing with constraints, including theory, algorithms, environments, languages, models, systems, and applications such as decision making, resource allocation, and agreement technologies.

This volume is the third in an ongoing series of books that deal with the state of the art in timetabling research. It contains a selection of the papers presented at the 3rd International Conference on the Practice and Theory of Automated Timetabling (PATAT 2000) held in Constance, Germany, on August 16{18th, 2000. The conference, once again, brought together researchers, practitioners, and vendors from all over the world working on all aspects of computer-aided timetable generation. The main aim of the PATAT conference series is to serve as an international and inter-disciplinary forum for new timetabling research results and directions. The conference series particularly aims to foster mul- disciplinary timetabling research. Our eld has always attracted scientists from a number of traditional domains including computer science and operational - search and we believe that the cross-fertilisation of ideas from di erent elds and disciplines is a very important factor in the future development of timetabling research. The Constance conference certainly met these aims. As can be seen from the selection of papers in this volume, there was a wide range of interesting approaches and ideas for a variety of timetabling application areas and there were delegates from many di

erent disciplines. It is clear that while considerable progress is being made in many areas of timetabling research, there are a number of important issues that researchers still have to face. In a contribution to the previous PATAT conference, George M.

DisCSP (Distributed Constraint Satisfaction Problem) is ageneral framework for solving distributed problems arising inDistributed Artificial Intelligence. A wide variety of problems in artificial intelligence are solvedusing the constraint satisfaction problem paradigm. However, thereare several applications in multi-agent coordination that are of adistributed nature. In this type of application, the knowledgeabout the problem, that is, variables and constraints, may belogically or geographically distributed among physical distributedagents. This distribution is mainly due to privacy and/or securityrequirements. Therefore, a distributed model allowing adecentralized solving process is more adequate to model and solvesuch kinds of problem. The distributed constraint satisfactionproblem has such properties. Contents Introduction Part 1. Background on Centralized and Distributed ConstraintReasoning 1. Constraint Satisfaction Problems 2. Distributed Constraint Satisfaction Problems Part 2. Synchronous Search Algorithms for DisCSPs 3. Nogood Based Asynchronous Forward Checking (AFC-ng) 4. Asynchronous Forward Checking Tree (AFC-tree) 5. Maintaining Arc Consistency Asynchronously in SynchronousDistributed Search Part 3. Asynchronous Search Algorithms and Ordering Heuristics forDisCSPs 6. Corrigendum to "Min-domain Retroactive Ordering forAsynchronous Backtracking" 7. Agile Asynchronous BackTracking (Agile-ABT) Part 4. DisChoco 2.0: A Platform for Distributed ConstraintReasoning 8. DisChoco 2.0 9. Conclusion About the Authors Mohamed Wahbi is currently an associate lecturer at Ecole desMines de Nantes in France. He received his PhD degree in ComputerScience from University Montpellier 2, France and Mohammed VUniversity-Agdal, Morocco in 2012 and his research focused onDistributed Constraint Reasoning.

An overview of algorithms important to computational structural biology that addresses such topics as NMR and design and analysis of proteins. Using the tools of information technology to understand the molecular machinery of the cell offers both challenges and opportunities to computational scientists. Over the past decade, novel algorithms have been developed both for analyzing biological data and for synthetic biology problems such as protein engineering. This book explains the algorithmic foundations and computational approaches underlying areas of structural biology including NMR (nuclear magnetic resonance); X-ray crystallography; and the design and analysis of proteins, peptides, and small molecules. Each chapter offers a concise overview of important concepts, focusing on a key topic in the field. Four chapters offer a short course in algorithmic and computational issues related to NMR structural biology, giving the reader a useful toolkit with which to approach the fascinating yet thorny computational problems in this area. A recurrent theme is understanding the interplay between biophysical experiments and computational algorithms. The text emphasizes the mathematical foundations of structural biology while maintaining a balance between algorithms and a nuanced understanding of experimental data. Three emerging areas, particularly fertile ground for research students, are highlighted: NMR methodology, design of proteins and other molecules, and the modeling of protein flexibility. The next generation of computational structural biologists will need training in geometric algorithms, provably good approximation algorithms, scientific computation, and an array of techniques for handling noise and uncertainty in combinatorial geometry and computational biophysics. This book is an essential guide for young scientists on their way to research success in this exciting field.

This book constitutes the refereed conference proceedings of the 18th International Conference on Principles and Practice of Constraint Programming (CP 2013), held in Uppsala, Sweden, in September 2013. The 61 revised papers presented together with 3 invited talks were carefully selected from 138 submissions. The scope of the conference is on all aspects of computing with constraints, including: theory, algorithms, environments, languages, models

and systems, applications such as decision making, resource allocation, and agreement technologies.

The purpose of a DIMACS Challenge is to encourage and coordinate research in the experimental analysis of algorithms. The First DIMACS Challenge encouraged experimental work in the area of network flow and matchings. This Second DIMACS Challenge, on which this volume is based, took place in conjunction with the DIMACS Special Year on Combinatorial Optimization. Addressed here are three difficult combinatorial optimization problems: finding cliques in a graph, colouring the vertices of a graph, and solving instances of the satisfiability problem. These problems were chosen both for their practical interest and because of their theoretical intractability.

This book is devoted to the 6th International Conference on Theory and applications of Satisability Testing (SAT 2003) held in Santa Margherita Ligure (Genoa, Italy), during May 5-8,2003. SAT 2003 followed the Workshops on S- is?ability held in Siena (1996), Paderborn (1998), and Renesse (2000), and the Workshop on Theory and Applications of Satis?ability Testing held in Boston (2001) and in Cincinnati (2002). As in the last edition, the SAT event hosted a SAT solvers competition, and, starting from the 2003 edition, also a Quanti?ed Boolean Formulas (QBFs) solvers comparative evaluation. There were 67 submissions of high quality, authored by researchers from all over the world. All the submissions were thoroughly evaluated, and as a result 42 were selected for oral presentations, and 16 for a poster presentation. The presentations covered the whole spectrum of research in propositional and QBF satis?ability testing, including proof systems, search techniques, probabilistic analysis of algorithms and their properties, problem encodings, industrial app- cations, specific tools, case studies and empirical results. Further, the program was enriched by three invited talks, given by Riccardo Zecchina (on "Survey Propagation: from Analytic Results on Random k-SAT to a Message-Passing algorithm for Satis?ability"), Toby Walsh (on "Challenges in SAT (and QBF)") and Wolfgang Kunz (on "ATPG Versus SAT: Comparing Two Paradigms for Boolean Reasoning"). SAT 2003 thus provided a unique forum for the presentation and discussion of research related to the theory and applications of pro- sitional and QBF satis?ability testing

THIS TEXTBOOK is about computer science. It is also about Python. However, there is much more. The study of algorithms and data structures is central to understanding what computer science is all about. Learning computer science is not unlike learning any other type of difficult subject matter. The only way to be successful is through deliberate and incremental exposure to the fundamental ideas. A beginning computer scientist needs practice so that there is a thorough understanding before continuing on to the more complex parts of the curriculum. In addition, a beginner needs to be given the opportunity to be successful and gain confidence. This textbook is designed to serve as a text for a first course on data structures and algorithms, typically taught as the second course in the computer science curriculum. Even though the second course is considered more advanced than the first course, this book assumes you are beginners at this level. You may still be struggling with some of the basic ideas and skills from a first computer science course and yet be ready to further explore the discipline and continue to practice problem solving. We cover abstract data types and data structures, writing algorithms, and solving problems. We look at a number of data structures and solve classic problems that arise. The tools and techniques that you learn here will be applied over and over as you continue your study of computer

science.

Cryptography, the art and science of creating secret codes, and cryptanalysis, the art and science of breaking secret codes, underwent a similar and parallel course during history. Both fields evolved from manual encryption methods and manual codebreaking techniques, to cipher machines and codebreaking machines in the first half of the 20th century, and finally to computerbased encryption and cryptanalysis from the second half of the 20th century. However, despite the advent of modern computing technology, some of the more challenging classical cipher systems and machines have not yet been successfully cryptanalyzed. For others, cryptanalytic methods exist, but only for special and advantageous cases, such as when large amounts of ciphertext are available. Starting from the 1990s, local search metaheuristics such as hill climbing, genetic algorithms, and simulated annealing have been employed, and in some cases, successfully, for the cryptanalysis of several classical ciphers. In most cases, however, results were mixed, and the application of such methods rather limited in their scope and performance. In this work, a robust framework and methodology for the cryptanalysis of classical ciphers using local search metaheuristics, mainly hill climbing and simulated annealing, is described. In an extensive set of case studies conducted as part of this research, this new methodology has been validated and demonstrated as highly effective for the cryptanalysis of several challenging cipher systems and machines, which could not be effectively cryptanalyzed before, and with drastic improvements compared to previously published methods. This work also led to the decipherment of original encrypted messages from WWI, and to the solution, for the first time, of several public cryptographic challenges.

This book constitutes the refereed proceedings of the 23rd International Symposium on the Mathematical Foundations of Computer Science, MFCS'98, held in Brno, Czech Republic, in August 1998. The 71 revised full papers presented were carefully reviewed and selected from a total of 168 submissions. Also included are 11 full invited surveys by prominent leaders in the area. The papers are organized in topical sections on problem complexity; logic, semantics, and automata; rewriting; automata and transducers; typing; concurrency, semantics, and logic; circuit complexity; programming; structural complexity; formal languages; graphs; Turing complexity and logic; binary decision diagrams, etc..

This book covers recent progress in solving propositional satisfiability and related problems. Propositional satisfiability is a powerful and general formalism used to solve a wide range of important problems including hardware and software verification. Research into methods to automate such reasoning has therefore a long history in artificial intelligence. This book follows on from the highly successful volume entitled SAT 2000 published five years ago.

This book constitutes the refereed proceedings of the 10th International Conference on Pervasive Computing, Pervasive 2012, held in Newcastle, UK, in June 2012. The 28 revised papers presented were carefully reviewed and selected from 138 submissions. The contributions are grouped into the following topical sections: activity capturing; urban mobility and computing; home and energy; HCI; development tools and devices; indoor location and positioning; social computing and games; privacy; public displays and services.

This book constitutes the refereed proceedings of the 8th European Conference on

Evolutionary Computation in Combinatorial Optimization, EvoCOP 2008, held in Naples, Italy, in March 2008. The 24 revised full papers presented were carefully reviewed and selected from 69 submissions. The papers present the latest research and discuss current developments and applications in metaheuristics - a paradigm to effectively solve difficult combinatorial optimization problems appearing in various industrial, economical, and scientific domains. Prominent examples of metaheuristics are evolutionary algorithms, simulated annealing, tabu search, scatter search, memetic algorithms, variable neighborhood search, iterated local search, greedy randomized adaptive search procedures, estimation of distribution algorithms and ant colony optimization.

In 2002, the International Conference on Computer Aided Design (ICCAD) celebrates its 20th anniversary. This book commemorates contributions made by ICCAD to the broad field of design automation during that time. The foundation of ICCAD in 1982 coincided with the growth of Large Scale Integration. The sharply increased functionality of board-level circuits led to a major demand for more powerful Electronic Design Automation (EDA) tools. At the same time, LSI grew quickly and advanced circuit integration became widely avail able. This, in turn, required new tools, using sophisticated modeling, analysis and optimization algorithms in order to manage the evermore complex design processes. Not surprisingly, during the same period, a number of start-up com panies began to commercialize EDA solutions, complementing various existing in-house efforts. The overall increased interest in Design Automation (DA) re quired a new forum for the emerging community of EDA professionals; one which would be focused on the publication of high-quality research results and provide a structure for the exchange of ideas on a broad scale. Many of the original ICCAD volunteers were also members of CANDE (Computer-Aided Network Design), a workshop of the IEEE Circuits and Sys tem Society. In fact, it was at a CANDE workshop that Bill McCalla suggested the creation of a conference for the EDA professional. (Bill later developed the name).

This book is dedicated to Jack Edmonds in appreciation of his ground breaking work that laid the foundations for a broad variety of subsequent results achieved in combinatorial optimization. The main part consists of 13 revised full papers on current topics in combinatorial optimization, presented at Aussois 2001, the Fifth Aussois Workshop on Combinatorial Optimization, March 5-9, 2001, and dedicated to Jack Edmonds. Additional highlights in this book are an account of an Aussois 2001 special session dedicated to Jack Edmonds including a speech given by William R. Pulleyblank as well as newly typeset versions of three up-to-now hardly accessible classical papers: - Submodular Functions, Matroids, and Certain Polyhedra by Jack Edmonds - Matching: A Well-Solved Class of Integer Linear Programs by Jack Edmonds and Ellis L. Johnson - Theoretical Improvements in Algorithmic Efficiency for Network Flow Problems by Jack Edmonds and Richard M. Karp.

The location of an object can often be determined from indirect measurements using a process called estimation. This book explains the mathematical formulation of location-estimation problems and the statistical properties of these mathematical models. It also presents algorithms that are used to resolve these models to obtain location estimates, including the simplest linear models, nonlinear models (location estimation using satellite navigation systems and estimation of the signal arrival time from those

satellites), dynamical systems (estimation of an entire path taken by a vehicle), and models with integer ambiguities (GPS location estimation that is centimeter-level accurate). Location Estimation from the Ground Up clearly presents analytic and algorithmic topics not covered in other books, including simple algorithms for Kalman filtering and smoothing, the solution of separable nonlinear optimization problems, estimation with integer ambiguities, and the implicit-function approach to estimating covariance matrices when the estimator is a minimizer or maximizer. It takes a unified approach to estimation while highlighting the differences between classes of estimation problems. The only book on estimation written for math and computer science students and graduates, it includes problems at the end of each chapter, many with solutions, to help readers deepen their understanding of the material and guide them through small programming projects that apply theory and algorithms to the solution of real-world location-estimation problems. The book's core audience consists of engineers, including software engineers and algorithm developers, and graduate students who work on location-estimation projects and who need help translating the theory into algorithms, code, and deep understanding of the problem in front of them. Instructors in mathematics, computer science, and engineering may also find the book of interest as a primary or supplementary text for courses in location estimation and navigation. This book focuses on the tactical planning level for spare parts management. It describes a series of multi-item inventory models and presents exact and heuristic optimization methods, including greedy heuristics that work well for real, life-sized problems. The intended audience consists of graduate students, starting scholars in the field of spare parts inventory control, and spare parts planning specialists in the industry. In individual chapters the authors consider topics including: a basic single-location model; single-location models with multiple machine types and/or machine groups; the multi-location model with lateral transshipments; the classical METRIC model and its generalization to multi-indenture systems; and a single-location model with an explicit modeling of the repair capacity for failed parts and the priorities that one can set there. Various chapters of the book are used in a master course at Eindhoven University of Technology and in a PhD course of the Graduate Program Operations Management and Logistics (a Dutch network that organizes PhD courses in the field of OM&L). The required pre-knowledge consists of probability theory and basic knowledge of Markov processes and queuing theory. End-of-chapter problems appear for all chapters, with some answers appearing in an appendix. This book constitutes the refereed proceedings of the 34th International Symposium on Mathematical Foundations of Computer Science, MFCS 2009, held in Novy Smokovec, High Tatras, Slovakia, in August 2009. The 56 revised full papers presented together with 7 invited lectures were carefully reviewed and selected from 148 submissions. All current aspects in theoretical computer science and its mathematical foundations are addressed, including algorithmic game theory, algorithmic tearning theory, algorithms and data structures, automata, grammars and formal languages, bioinformatics, complexity, computational geometry, computer-assisted reasoning, concurrency theory, cryptography and security, databases and knowledge-based systems, formal specifications and program development, foundations of computing, logic in computer science, mobile computing, models of computation, networks, parallel and distributed computing, quantum computing, semantics and verification of programs, theoretical

issues in artificial intelligence.

This revised and extensively expanded edition of Computability and Complexity Theory comprises essential materials that are core knowledge in the theory of computation. The book is self-contained, with a preliminary chapter describing key mathematical concepts and notations. Subsequent chapters move from the qualitative aspects of classical computability theory to the quantitative aspects of complexity theory. Dedicated chapters on undecidability, NP-completeness, and relative computability focus on the limitations of computability and the distinctions between feasible and intractable. Substantial new content in this edition includes: a chapter on nonuniformity studying Boolean circuits, advice classes and the important result of Karp?Lipton. a chapter studying properties of the fundamental probabilistic complexity classes a study of the alternating Turing machine and uniform circuit classes. an introduction of counting classes, proving the famous results of Valiant and Vazirani and of Toda a thorough treatment of the proof that IP is identical to PSPACE With its accessibility and well-devised organization, this text/reference is an excellent resource and guide for those looking to develop a solid grounding in the theory of computing. Beginning graduates, advanced undergraduates, and professionals involved in theoretical computer science, complexity theory, and computability will find the book an essential and practical learning tool. Topics and features: Concise, focused materials cover the most fundamental concepts and results in the field of modern complexity theory, including the theory of NP-completeness, NP-hardness, the polynomial hierarchy, and complete problems for other complexity classes Contains information that otherwise exists only in research literature and presents it in a unified, simplified manner Provides key mathematical background information, including sections on logic and number theory and algebra Supported by numerous exercises and supplementary problems for reinforcement and self-study purposes

This book is Part I of the fourth edition of Robert Sedgewick and Kevin Wayne's Algorithms , the leading textbook on algorithms today, widely used in colleges and universities worldwide. Part I contains Chapters 1 through 3 of the book. The fourth edition of Algorithms surveys the most important computer algorithms currently in use and provides a full treatment of data structures and algorithms for sorting, searching, graph processing, and string processing -- including fifty algorithms every programmer should know. In this edition, new Java implementations are written in an accessible modular programming style, where all of the code is exposed to the reader and ready to use. The algorithms in this book represent a body of knowledge developed over the last 50 years that has become indispensable, not just for professional programmers and computer science students but for any student with interests in science, mathematics, and engineering, not to mention students who use computation in the liberal arts. The companion web site, algs4.cs.princeton.edu contains An online synopsis Full Java implementations Test data Exercises and answers Dynamic visualizations Lecture slides Programming assignments with checklists Links to related material The MOOC related to this book is accessible via the "Online Course" link at algs4.cs.princeton.edu. The course offers more than 100 video lecture segments that are integrated with the text, extensive online assessments, and the large-scale discussion forums that have proven so valuable. Offered each fall and spring, this course regularly attracts tens of thousands of registrants. Robert Sedgewick and Kevin Wayne are developing a modern

approach to disseminating knowledge that fully embraces technology, enabling people all around the world to discover new ways of learning and teaching. By integrating their textbook, online content, and MOOC, all at the state of the art, they have built a unique resource that greatly expands the breadth and depth of the educational experience.
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