



ESSAYS AND SURVEYS IN METAHEURISTICS

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Essays And Surveys In Metaheuristics

Celso C. Ribeiro, Pierre Hansen



Essays And Surveys In Metaheuristics:

Essays and Surveys in Metaheuristics Celso C. Ribeiro, Pierre Hansen, 2012-12-06 Finding exact solutions to many combinatorial optimization problems in business engineering and science still poses a real challenge despite the impact of recent advances in mathematical programming and computer technology New fields of applications such as computational biology electronic commerce and supply chain management bring new challenges and needs for algorithms and optimization techniques Metaheuristics are master procedures that guide and modify the operations of subordinate heuristics to produce improved approximate solutions to hard optimization problems with respect to more simple algorithms They also provide fast and robust tools producing high quality solutions in reasonable computation times The field of metaheuristics has been fast evolving in recent years Techniques such as simulated annealing tabu search genetic algorithms scatter search greedy randomized adaptive search variable neighborhood search ant systems and their hybrids are currently among the most efficient and robust optimization strategies to find high quality solutions to many real life optimization problems A very large number of successful applications of metaheuristics are reported in the literature and spread throughout many books journals and conference proceedings A series of international conferences entirely devoted to the theory applications and computational developments in metaheuristics has been attracting an increasing number of participants from universities and the industry

Handbook of Metaheuristics Fred W. Glover, Gary A. Kochenberger, 2006-04-11 Metaheuristics in their original definition are solution methods that orchestrate an interaction between local improvement procedures and higher level strategies to create a process capable of escaping from local optima and performing a robust search of a solution space Over time these methods have also come to include any procedures that employ strategies for overcoming the trap of local optimality in complex solution spaces especially those procedures that utilize one or more neighborhood structures as a means of defining admissible moves to transition from one solution to another or to build or destroy solutions in constructive and destructive processes The degree to which neighborhoods are exploited varies according to the type of procedure In the case of certain population based procedures such as genetic algorithms neighborhoods are implicitly and somewhat restrictively defined by reference to replacing components of one solution with those of another by variously chosen rules of exchange popularly given the name of crossover In other population based methods based on the notion of path relinking neighborhood structures are used in their full generality including constructive and destructive neighborhoods as well as those for transitioning between complete solutions Certain hybrids of classical evolutionary approaches which link them with local search also use neighborhood structures more fully though apart from the combination process itself

Handbook of Metaheuristics Michel Gendreau, Jean-Yves Potvin, 2018-09-20 The third edition of this handbook is designed to provide a broad coverage of the concepts implementations and applications in metaheuristics The book's chapters serve as stand alone presentations giving both the necessary underpinnings as well as practical guides for implementation The nature of

metaheuristics invites an analyst to modify basic methods in response to problem characteristics past experiences and personal preferences and the chapters in this handbook are designed to facilitate this process as well This new edition has been fully revised and features new chapters on swarm intelligence and automated design of metaheuristics from flexible algorithm frameworks The authors who have contributed to this volume represent leading figures from the metaheuristic community and are responsible for pioneering contributions to the fields they write about Their collective work has significantly enriched the field of optimization in general and combinatorial optimization in particular Metaheuristics are solution methods that orchestrate an interaction between local improvement procedures and higher level strategies to create a process capable of escaping from local optima and performing a robust search of a solution space In addition many new and exciting developments and extensions have been observed in the last few years Hybrids of metaheuristics with other optimization techniques like branch and bound mathematical programming or constraint programming are also increasingly popular On the front of applications metaheuristics are now used to find high quality solutions to an ever growing number of complex ill defined real world problems in particular combinatorial ones This handbook should continue to be a great reference for researchers graduate students as well as practitioners interested in metaheuristics New Optimization Techniques in Engineering Godfrey C. Onwubolu,B. V. Babu,2004-01-21

Presently general purpose optimization techniques such as Simulated Annealing and Genetic Algorithms have become standard optimization techniques Concerted research efforts have been made recently in order to invent novel optimization techniques for solving real life problems which have the attributes of memory update and population based search solutions The book describes a variety of these novel optimization techniques which in most cases outperform the standard optimization techniques in many application areas New Optimization Techniques in Engineering reports applications and results of the novel optimization techniques considering a multitude of practical problems in the different engineering disciplines presenting both the background of the subject area and the techniques for solving the problems Metaheuristics Mauricio G.C. Resende,J. Pinho de Sousa,2013-06-29

Combinatorial optimization is the process of finding the best or optimal solution for problems with a discrete set of feasible solutions Applications arise in numerous settings involving operations management and logistics such as routing scheduling packing inventory and production management location logic and assignment of resources The economic impact of combinatorial optimization is profound affecting sectors as diverse as transportation airlines trucking rail and shipping forestry manufacturing logistics aerospace energy electrical power petroleum and natural gas telecommunications biotechnology financial services and agriculture While much progress has been made in finding exact provably optimal solutions to some combinatorial optimization problems using techniques such as dynamic programming cutting planes and branch and cut methods many hard combinatorial problems are still not solved exactly and require good heuristic methods Moreover reaching optimal solutions is in many cases meaningless as in practice we are often dealing with models that are rough

simplifications of reality The aim of heuristic methods for combinatorial optimization is to quickly produce good quality solutions without necessarily providing any guarantee of solution quality Metaheuristics are high level procedures that coordinate simple heuristics such as local search to find solutions that are of better quality than those found by the simple heuristics alone Modern metaheuristics include simulated annealing genetic algorithms tabu search GRASP scatter search ant colony optimization variable neighborhood search and their hybrids

Handbook of Approximation Algorithms and Metaheuristics Teofilo F. Gonzalez, 2018-05-15 Handbook of Approximation Algorithms and Metaheuristics Second Edition reflects the tremendous growth in the field over the past two decades Through contributions from leading experts this handbook provides a comprehensive introduction to the underlying theory and methodologies as well as the various applications of approximation algorithms and metaheuristics Volume 1 of this two volume set deals primarily with methodologies and traditional applications It includes restriction relaxation local ratio approximation schemes randomization tabu search evolutionary computation local search neural networks and other metaheuristics It also explores multi objective optimization reoptimization sensitivity analysis and stability Traditional applications covered include bin packing multi dimensional packing Steiner trees traveling salesperson scheduling and related problems Volume 2 focuses on the contemporary and emerging applications of methodologies to problems in combinatorial optimization computational geometry and graphs problems as well as in large scale and emerging application areas It includes approximation algorithms and heuristics for clustering networks sensor and wireless communication bioinformatics search streams virtual communities and more About the Editor Teofilo F Gonzalez is a professor emeritus of computer science at the University of California Santa Barbara He completed his Ph D in 1975 from the University of Minnesota He taught at the University of Oklahoma the Pennsylvania State University and the University of Texas at Dallas before joining the UCSB computer science faculty in 1984 He spent sabbatical leaves at the Monterrey Institute of Technology and Higher Education and Utrecht University He is known for his highly cited pioneering research in the hardness of approximation for his sublinear and best possible approximation algorithm for k tMM clustering for introducing the open shop scheduling problem as well as algorithms for its solution that have found applications in numerous research areas as well as for his research on problems in the areas of job scheduling graph algorithms computational geometry message communication wire routing etc

Metaheuristics Marc Sevaux, Alexandru-Liviu Olteanu, Eduardo G. Pardo, Angelo Sifaleras, Salma Makboul, 2024-06-17 This volume constitutes the refereed proceedings of Metaheuristics on 15th International Conference MIC 2024 held in Lorient France during June 4-7 2024 The 36 full papers presented together with 34 short papers were carefully reviewed and selected from 127 submissions The conference focuses on artificial intelligence combinatorial optimization computer science graph theory evolutionary algorithms genetic algorithms simulated annealing optimization optimization problems

Metaheuristics Patrick Siarry, 2016-12-24 Metaheuristics exhibit desirable properties like simplicity easy parallelizability and ready applicability to

different types of optimization problems After a comprehensive introduction to the field the contributed chapters in this book include explanations of the main metaheuristics techniques including simulated annealing tabu search evolutionary algorithms artificial ants and particle swarms followed by chapters that demonstrate their applications to problems such as multiobjective optimization logistics vehicle routing and air traffic management The authors are leading researchers in this domain with considerable teaching and applications experience and the book will be of value to industrial practitioners graduate students and research academics Metaheuristics for Hard Optimization Johann Dréo,2006 Contains case studies from engineering and operations research Includes commented literature for each chapter *Encyclopedia of Decision Making and Decision Support Technologies* Adam, Frederic,Humphreys, Patrick,2008-04-30 As effective organizational decision making is a major factor in a company s success a comprehensive account of current available research on the core concepts of the decision support agenda is in high demand by academicians and professionals Through 110 authoritative contributions by over 160 of the world s leading experts the Encyclopedia of Decision Making and Decision Support Technologies presents a critical mass of research on the most up to date research on human and computer support of managerial decision making including discussion on support of operational tactical and strategic decisions human vs computer system support structure individual and group decision making and multi criteria decision making *Proceedings of the 2018 Conference of the Computational Social Science Society of the Americas* Ted Carmichael,Zining Yang,2020-05-27 This book contains a selection of the latest research in the field of Computational Social Science CSS methods uses and results as presented at the 2018 annual conference of the CSSSA This conference was held in Santa Fe New Mexico October 25 28 2018 at the Drury Plaza Hotel CSS investigates social and behavioral dynamics in both nature and society through computer simulation network analysis and the science of complex systems The Computational Social Science Society of the Americas CSSSA is a professional society that aims to advance the field of CSS in all its areas from fundamental principles to real world applications by holding conferences and workshops promoting standards of scientific excellence in research and teaching and publishing novel research findings What follows is a diverse representation of new approaches and research findings using the tools of CSS and Agent Based Modeling ABM in exploring complex phenomena across many different domains Readers will not only have the methods and results of these specific projects on which to build but will also gain a greater appreciation for the broad scope of CSS and have a wealth of case study examples that can serve as meaningful exemplars for new research projects and activities This book we hope will appeal to any researchers and students working in the social sciences broadly defined who aim to better understand and apply the concepts of Complex Adaptive Systems to their work Learning and Intelligent Optimization Vittorio Maniezzo,Roberto Battiti,Jean-Paul Watson,2008-12-17 This volume collects the accepted papers presented at the Learning and Intelligent OptimizatioN conference LION 2007 II held December 8 12 2007 in Trento Italy The motivation for the meeting is related to the current explosion in the number and

variety of heuristic algorithms for hard optimization problems which raises merous interesting and challenging issues Practitioners are confronted with the b den of selecting the most appropriate method in many cases through an expensive algorithm configuration and parameter tuning process and subject to a steep learning curve Scientists seek theoretical insights and demand a sound experimental meth ology for evaluating algorithms and assessing strengths and weaknesses A necessary prerequisite for this effort is a clear separation between the algorithm and the expe menter who in too many cases is in the loop as a crucial intelligent learning c ponent Both issues are related to designing and engineering ways of learning about the performance of different techniques and ways of using memory about algorithm behavior in the past to improve performance in the future Intelligent learning schemes for mining the knowledge obtained from different runs or during a single run can prove the algorithm development and design process and simplify the applications of high performance optimization methods Combinations of algorithms can further improve the robustness and performance of the individual components provided that sufficient knowledge of the relationship between problem instance characteristics and algorithm performance is obtained

Computational Intelligence Methods for Bioinformatics and Biostatistics Elia Biganzoli, Alfredo Vellido, Federico Ambrogi, Roberto Tagliaferri, 2012-12-11 This book constitutes the thoroughly refereed post proceedings of the 8th International Meeting on Computational Intelligence Methods for Bioinformatics and Biostatistics CIBB 2011 held in Gargnano del Garda Italy in June July 2011 The 19 papers presented together with 2 keynote speeches were carefully reviewed and selected from 24 submissions The papers are organized in topical sections on statistical learning genomics computational intelligence for health at the edge proteomics intelligent clinical decision support systems i CDSS bioinformatics and data clustering

Combinatorial Models for Scheduling Sports Tournaments Celso C. Ribeiro, Sebastián Urrutia, Dominique de Werra, 2023-10-03 This book introduces solutions for sports scheduling problems in a variety of settings In particular the book covers timetabling the traveling tournament problem carryover minimization breaks minimization tournament design tournament planning and referee assignment A rich selection of applications to sports such as football baseball basketball cricket or hockey are employed to illustrate the methods and techniques In a step by step tutorial format the book describes the use of graph theory concepts local search operators and integer programming in the context of sports scheduling The methods presented in this book are essential to sports scheduling in all its dimensions from tournaments that are followed by millions of people across the world with broadcast rights that amount to hundreds of millions of dollars in some competitions to amateur leagues that require coordination and logistical efforts due to the large number of tournaments and competitors

Network Design with Applications to Transportation and Logistics Teodor Gabriel Crainic, Michel Gendreau, Bernard Gendron, 2021-07-16 This book explores the methodological and application developments of network design in transportation and logistics It identifies trends challenges and research perspectives in network design for these areas Network design is a major class of problems in operations research where network flow

combinatorial and mixed integer optimization meet The analysis and planning of transportation and logistics systems continues to be one of the most important application areas of operations research Networks provide the natural way of depicting such systems so the optimal design and operation of networks is the main methodological area of operations research that is used for the analysis and planning of these systems This book defines the current state of the art in the general area of network design and then turns to its applications to transportation and logistics New research challenges are addressed Network Design with Applications to Transportation and Logistics is divided into three parts Part I examines basic design problems including fixed cost network design and parallel algorithms After addressing the basics Part II focuses on more advanced models Chapters cover topics such as multi facility network design flow constrained network design and robust network design Finally Part III is dedicated entirely to the potential application areas for network design These areas range from rail networks to city logistics to energy transport All of the chapters are written by leading researchers in the field which should appeal to analysts and planners

Handbook of Metaheuristic Algorithms Chun-Wei Tsai, Ming-Chao Chiang, 2023-05-30 Handbook of Metaheuristic Algorithms From Fundamental Theories to Advanced Applications provides a brief introduction to metaheuristic algorithms from the ground up including basic ideas and advanced solutions Although readers may be able to find source code for some metaheuristic algorithms on the Internet the coding styles and explanations are generally quite different and thus requiring expanded knowledge between theory and implementation This book can also help students and researchers construct an integrated perspective of metaheuristic and unsupervised algorithms for artificial intelligence research in computer science and applied engineering domains Metaheuristic algorithms can be considered the epitome of unsupervised learning algorithms for the optimization of engineering and artificial intelligence problems including simulated annealing SA tabu search TS genetic algorithm GA ant colony optimization ACO particle swarm optimization PSO differential evolution DE and others Distinct from most supervised learning algorithms that need labeled data to learn and construct determination models metaheuristic algorithms inherit characteristics of unsupervised learning algorithms used for solving complex engineering optimization problems without labeled data just like self learning to find solutions to complex problems Presents a unified framework for metaheuristics and describes well known algorithms and their variants Introduces fundamentals and advanced topics for solving engineering optimization problems e g scheduling problems sensors deployment problems and clustering problems Includes source code based on the unified framework for metaheuristics used as examples to show how TS SA GA ACO PSO DE parallel metaheuristic algorithm hybrid metaheuristic local search and other advanced technologies are realized in programming languages such as C and Python

Computational Science and Technology Rayner Alfred, Yuto Lim, Ag Asri Ag Ibrahim, Patricia Anthony, 2018-08-27 This book features the proceedings of the Fifth International Conference on Computational Science and Technology 2018 ICCST2018 held in Kota Kinabalu Malaysia on 29 30 August 2018 Of interest to practitioners and researchers it presents exciting advances in computational

techniques and solutions in this area It also identifies emerging issues to help shape future research directions and enable industrial users to apply cutting edge large scale and high performance computational methods **Metaheuristic**

Procedures for Training Neural Networks Enrique Alba,Rafael Martí,2006-08-25 Metaheuristic Procedures For Training Neural Networks provides successful implementations of metaheuristic methods for neural network training Moreover the basic principles and fundamental ideas given in the book will allow the readers to create successful training methods on their own Apart from Chapter 1 which reviews classical training methods the chapters are divided into three main categories The first one is devoted to local search based methods including Simulated Annealing Tabu Search and Variable Neighborhood Search The second part of the book presents population based methods such as Estimation Distribution algorithms Scatter Search and Genetic Algorithms The third part covers other advanced techniques such as Ant Colony Optimization Co evolutionary methods GRASP and Memetic algorithms Overall the book s objective is engineered to provide a broad coverage of the concepts methods and tools of this important area of ANNs within the realm of continuous optimization **Fuzzy**

Applications in Industrial Engineering Cengiz Kahraman,2007-05-31 Industrial Engineering IE is concerned with the design improvement and installation of integrated systems of people material equipment and energy Industrial engineers face many problems with incomplete and vague information in these systems since the characteristics of these problems often require this kind of information Fuzzy sets approaches are usually most appropriate when human evaluations and the modeling of human knowledge are needed IE brings a significant number of applications of fuzzy set theory After an introductory chapter explaining the recent status of fuzzy sets in IE this volume involves application chapters on the major seven areas of IE to which fuzzy set theory can contribute These major application areas are Control and Reliability Engineering Economics and Investment Analysis Group and Multi criteria Decision making Human Factors Engineering and Ergonomics Manufacturing Systems and Technology Management Optimization Techniques and Statistical Decision making Under these major areas every chapter includes didactic numerical applications The authors Among many authors in this book some examples are H J Zimmermann Janusz Kacprzyk Hideo Tanaka Waldemar Karwowski F Herrera C Kolski P Paul Wang E Herrera Viedma Hung T Nguyen Vladik Kreinovich Jose L Verdegay Tomoe Entani Nikos Tsourveloudis F Jimenez

Handbook of Research on Artificial Intelligence Techniques and Algorithms Vasant, Pandian,2014-11-30 For decades optimization methods such as Fuzzy Logic Artificial Neural Networks Firefly Simulated annealing and Tabu search have been capable of handling and tackling a wide range of real world application problems in society and nature Analysts have turned to these problem solving techniques in the event during natural disasters and chaotic systems research The Handbook of Research on Artificial Intelligence Techniques and Algorithms highlights the cutting edge developments in this promising research area This premier reference work applies Meta heuristics Optimization MO Techniques to real world problems in a variety of fields including business logistics computer science engineering and government This work is

particularly relevant to researchers scientists decision makers managers and practitioners

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