

The Vehicle Routing Problem with Service Level Constraints

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Abstract. We consider a vehicle routing problem which seeks to minimize cost subject to service level constraints on several groups of deliveries. This problem captures some essential challenges faced by a logistics provider which operates transportation services for a limited number of partners and should respect contractual obligations on service levels. The problem also generalizes several important classes of vehicle routing problems with profits. To solve it, we propose a compact mathematical formulation, a branch-and-price algorithm, and a hybrid genetic algorithm with population management, which relies on problem-tailored solution representation, crossover and local search operators, as well as an adaptive penalization mechanism establishing a good balance between service levels and costs. Our computational experiments show that the proposed heuristic returns very high-quality solutions for this difficult problem, matches all optimal solutions found for small and medium-scale benchmark instances, and improves upon existing algorithms for two important special cases: the vehicle routing problem with private fleet and common carrier, and the capacitated profitable tour problem. The branch-and-price algorithm also produces new optimal solutions for all three problems.

Keywords. Routing, collaborative logistics, service level constraints, integer programming, genetic algorithms.

The Vehicle Routing Problem With Service Level Constraints

Pierrick Legrand, Arnaud Liefoghe, Julien Lepagnet, Nicolas Monmarché, Lhassane Idoumghar, Denis Pallez, Patrick Siarry, Evelyne Lutton

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Artificial Evolution Pierrick Legrand, Arnaud Liefooghe, Julien Lepagnot, Nicolas Monmarché, Lhassane Idoumghar, Denis Pallez, Patrick Siarry, Evelyne Lutton, 2025-11-15 This book constitutes the refereed post conference proceedings of the 16th International Conference on Artificial Evolution EA 2024 held in Bordeaux France during October 29-31 2024 The 16 full papers were carefully reviewed and selected from 30 submissions The papers cover a wide range of topics in the field of artificial evolution including Algorithmics and Modeling Implementations Application of Evolutionary Paradigms to the Real World industry biosciences Machine Learning and hybridization with other soft computing techniques *Optimization and Management in Manufacturing Engineering* Xinbao Liu, Jun Pei, Lin Liu, Hao Cheng, Mi Zhou, Panos M. Pardalos, 2017-10-02 Problems facing manufacturing clusters that intersect information technology process management and optimization within the Internet of Things IoT are examined in this book Recent advances in information technology have transformed the use of resources and data exchange often leading to management and optimization problems attributable to technology limitations and strong market competition This book discusses several problems and concepts which makes significant connections in the areas of information sharing organization management resource operations and performance assessment Geared toward practitioners and researchers this treatment deepens the understanding between resource collaborative management and advanced information technology Those in manufacturing will utilize the numerous mathematical models and methods offered to solve practical problems related to cutting stock supply chain scheduling and inventory management Academics and students with a basic knowledge of manufacturing combinatorics and linear programming will find that this discussion widens the research area of resource collaborative management and unites the fields of information technology manufacturing management and optimization **Web Services: Concepts, Methodologies, Tools, and Applications** Management Association, Information Resources, 2018-12-07 Web service technologies are redefining the way that large and small companies are doing business and exchanging information Due to the critical need for furthering automation engagement and efficiency systems and workflows are becoming increasingly more web based Web Services Concepts Methodologies Tools and Applications is an innovative reference source that examines relevant theoretical frameworks current practice guidelines industry standards and standardization and the latest empirical research findings in web services Highlighting a range of topics such as cloud computing quality of service and semantic web this multi volume book is designed for computer engineers IT specialists software designers professionals researchers and upper level students interested in web services architecture frameworks and security [Contemporary Issues in Systems Science and Engineering](#) MengChu Zhou, Han-Xiong Li, Margot Weijnen, 2015-04-20 Various systems science and engineering disciplines are covered and challenging new research issues in these disciplines are revealed They will be extremely valuable for the readers to search for some new research directions and problems Chapters are contributed by world renowned systems

engineers Chapters include discussions and conclusions Readers can grasp each event holistically without having professional expertise in the field

Fundamentals of Supply Chain Theory Lawrence V. Snyder,Zuo-Jun Max Shen,2019-07-01 Comprehensively teaches the fundamentals of supply chain theory This book presents the methodology and foundations of supply chain management and also demonstrates how recent developments build upon classic models The authors focus on strategic tactical and operational aspects of supply chain management and cover a broad range of topics from forecasting inventory management and facility location to transportation process flexibility and auctions Key mathematical models for optimizing the design operation and evaluation of supply chains are presented as well as models currently emerging from the research frontier Fundamentals of Supply Chain Theory Second Edition contains new chapters on transportation traveling salesman and vehicle routing problems integrated supply chain models and applications of supply chain theory New sections have also been added throughout on topics including machine learning models for forecasting conic optimization for facility location a multi supplier model for supply uncertainty and a game theoretic analysis of auctions The second edition also contains case studies for each chapter that illustrate the real world implementation of the models presented This edition also contains nearly 200 new homework problems over 60 new worked examples and over 140 new illustrative figures Plentiful teaching supplements are available including an Instructor s Manual and PowerPoint slides as well as MATLAB programming assignments that require students to code algorithms in an effort to provide a deeper understanding of the material Ideal as a textbook for upper undergraduate and graduate level courses in supply chain management in engineering and business schools Fundamentals of Supply Chain Theory Second Edition will also appeal to anyone interested in quantitative approaches for studying supply chains

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Statistics in Simulation Simulation in risk analysis Risk Analysis Using Crystal Ball Applications of Risk Analysis Building System Simulation Models Systems simulation Output Analysis and Experimentation for Systems Simulation Systems Simulation Using ProcessModel Applications of Systems Simulation Extensions of simulation Simulation in Forecasting and Optimization

Network Routing Michael O. Ball, 1995-10-30 The papers in this volume consider a general area of study known as network routing The underlying problems are conceptually simple yet mathematically complex and challenging How can we best route material or people from one place to another Or how can we best design a system for instance locate facilities to provide services and goods as efficiently and equitably as possible The problems encountered in answering these questions often have an underlying combinatorial structure for example either we dispatch a vehicle or we do not or we use one particular route or another The problems also typically have an underlying network structure a communication or transportation network In addition models for these problems are often very large with hundreds or thousands of constraints and variables A companion volume in the Handbook series entitled Network Models treats basic network models such as minimum cost flows matching and the travelling salesman problem as well as several complex network topics not directly related to routing such as network design and network reliability

An Integrated Systems Approach to the Development of Winter Maintenance, 2006 Winter road maintenance operations require many complex strategic and operational planning decisions The five primary problems involved in this intricate planning procedure include locating depots designing sectors routing service vehicles scheduling vehicles and configuring the vehicle fleet The complexity involved in each of these decisions has resulted mainly in research that approaches each of the problems separately and sequentially which can lead to isolated and suboptimal solutions After discussing the complexity of the relaxed subproblems that would need to be solved to optimize the intricate winter maintenance operations the research turns to a heuristic approach to more feasibly address the interrelated problems This report subsequently presents a systematic heuristic based optimization approach to integrate the winter road maintenance planning decisions for depot location sector design vehicle route design vehicle scheduling and fleet configuration The approach presented is illustrated through an example of public sector winter road maintenance planning for a rural transportation network in Boone County Missouri When applied to the real world winter road maintenance planning problems for Boone County the methodology delivered very promising results The solution methodology successfully achieves the objective of a more integrated and less sequential approach to the problems considered The integrated solution would allow the Missouri Department of Transportation MoDOT to maintain the same high level of service with significantly fewer resources The results indicate that this methodology is a successful step towards solving realistic multiple depot problems involving heterogeneous winter maintenance fleets

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Table of Contents The Vehicle Routing Problem With Service Level Constraints

1. Understanding the eBook The Vehicle Routing Problem With Service Level Constraints
 - The Rise of Digital Reading The Vehicle Routing Problem With Service Level Constraints
 - Advantages of eBooks Over Traditional Books
2. Identifying The Vehicle Routing Problem With Service Level Constraints
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an The Vehicle Routing Problem With Service Level Constraints
 - User-Friendly Interface
4. Exploring eBook Recommendations from The Vehicle Routing Problem With Service Level Constraints
 - Personalized Recommendations
 - The Vehicle Routing Problem With Service Level Constraints User Reviews and Ratings

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- The Vehicle Routing Problem With Service Level Constraints and Bestseller Lists
- 5. Accessing The Vehicle Routing Problem With Service Level Constraints Free and Paid eBooks
 - The Vehicle Routing Problem With Service Level Constraints Public Domain eBooks
 - The Vehicle Routing Problem With Service Level Constraints eBook Subscription Services
 - The Vehicle Routing Problem With Service Level Constraints Budget-Friendly Options
- 6. Navigating The Vehicle Routing Problem With Service Level Constraints eBook Formats
 - ePub, PDF, MOBI, and More
 - The Vehicle Routing Problem With Service Level Constraints Compatibility with Devices
 - The Vehicle Routing Problem With Service Level Constraints Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of The Vehicle Routing Problem With Service Level Constraints
 - Highlighting and Note-Taking The Vehicle Routing Problem With Service Level Constraints
 - Interactive Elements The Vehicle Routing Problem With Service Level Constraints
- 8. Staying Engaged with The Vehicle Routing Problem With Service Level Constraints
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers The Vehicle Routing Problem With Service Level Constraints
- 9. Balancing eBooks and Physical Books The Vehicle Routing Problem With Service Level Constraints
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection The Vehicle Routing Problem With Service Level Constraints
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine The Vehicle Routing Problem With Service Level Constraints
 - Setting Reading Goals The Vehicle Routing Problem With Service Level Constraints
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of The Vehicle Routing Problem With Service Level Constraints
 - Fact-Checking eBook Content of The Vehicle Routing Problem With Service Level Constraints
 - Distinguishing Credible Sources

13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
14. Embracing eBook Trends
 - Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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