Path Problems in Networks

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Path Problems In Networks George Theodorakopoulos:

Path Problems in Networks John Baras,George Theodorakopoulos,2022-06-01 The algebraic path problem is a generalization of the shortest path problem in graphs Various instances of this abstract problem have appeared in the literature and similar solutions have been independently discovered and rediscovered The repeated appearance of a problem is evidence of its relevance This book aims to help current and future researchers add this powerful tool to their arsenal so that they can easily identify and use it in their own work Path problems in networks can be conceptually divided into two parts A distillation of the extensive theory behind the algebraic path problem and an exposition of a broad range of applications First of all the shortest path problem is presented so as to fix terminology and concepts existence and uniqueness of solutions robustness to parameter changes and centralized and distributed computation algorithms Then these concepts are generalized to the algebraic context of semirings Methods for creating new semirings useful for modeling new problems are provided A large part of the book is then devoted to numerous applications of the algebraic path problem ranging from mobile network routing to BGP routing to social networks These applications show what kind of problems can be modeled as algebraic path problems they also serve as examples on how to go about modeling new problems This monograph will be useful to network researchers engineers and graduate students It can be used either as an introduction to the topic or as a quick reference to the theoretical facts algorithms and application examples The theoretical background assumed for the reader is that of a graduate or advanced undergraduate student in computer science or engineering Some familiarity with algebra and algorithms is helpful but not necessary Algebra in particular is used as a convenient and concise language to describe problems that are essentially combinatorial Table of Contents Classical Shortest Path The Algebraic Path Problem Properties and Computation of Solutions Applications Related Areas List of Semirings and Applications

Modeling and Optimization in Software-Defined Networks Konstantinos Poularakis,Leandros Tassiulas,T.V. Lakshman,2022-06-01 This book provides a quick reference and insights into modeling and optimization of software defined networks SDNs It covers various algorithms and approaches that have been developed for optimizations related to the control plane the considerable research related to data plane optimization and topics that have significant potential for research and advances to the state of the art in SDN Over the past ten years network programmability has transitioned from research concepts to more mainstream technology through the advent of technologies amenable to programmability such as service chaining virtual network functions and programmability of the data plane However the rapid development in SDN technologies has been the key driver behind its evolution The logically centralized abstraction of network states enabled by SDN facilitates programmability and use of sophisticated optimization and control algorithms for enhancing network performance policy management and security Furthermore the centralized aggregation of network telemetry facilitates use of data driven machine learning based methods To fully unleash the power of this new SDN paradigm though various

architectural design deployment and operations questions need to be addressed Associated with these are various modeling resource allocation and optimization opportunities The book covers these opportunities and associated challenges which represent a call to arms for the SDN community to develop new modeling and optimization methods that will complement or improve on the current norms   *A Primer on Physical-Layer Network Coding* Soung Chang Liew,Lu Lu,Shengli Zhang,2022-05-31 The concept of physical layer network coding PNC was proposed in 2006 for application in wireless networks Since then it has developed into a subfield of communications and networking with a wide following This book is a primer on PNC It is the outcome of a set of lecture notes for a course for beginning graduate students at The Chinese University of Hong Kong The target audience is expected to have some prior background knowledge in communication theory and wireless communications but not working knowledge at the research level Indeed a goal of this book course is to allow the reader to gain a deeper appreciation of the various nuances of wireless communications and networking by focusing on problems arising from the study of PNC Specifically we introduce the tools and techniques needed to solve problems in PNC and many of these tools and techniques are drawn from the more general disciplines of signal processing communications and networking PNC is used as a pivot to learn about the fundamentals of signal processing techniques and wireless communications in general We feel that such a problem centric approach will give the reader a more in depth understanding of these disciplines and allow him her to see first hand how the techniques of these disciplines can be applied to solve real research problems As a primer this book does not cover many advanced materials related to PNC PNC is an active research field and many new results will no doubt be forthcoming in the near future We believe that this book will provide a good contextual framework for the interpretation of these advanced results should the reader decide to probe further into the field of PNC   Network Connectivity Chen Chen,Hanghang Tong,2022-05-31 Networks naturally appear in many high impact domains ranging from social network analysis to disease dissemination studies to infrastructure system design Within network studies network connectivity plays an important role in a myriad of applications The diversity of application areas has spurred numerous connectivity measures each designed for some specific tasks Depending on the complexity of connectivity measures the computational cost of calculating the connectivity score can vary significantly Moreover the complexity of the connectivity would predominantly affect the hardness of connectivity optimization which is a fundamental problem for network connectivity studies This book presents a thorough study in network connectivity including its concepts computation and optimization Specifically a unified connectivity measure model will be introduced to unveil the commonality among existing connectivity measures For the connectivity computation aspect the authors introduce the connectivity tracking problems and present several effective connectivity inference frameworks under different network settings Taking the connectivity optimization perspective the book analyzes the problem theoretically and introduces an approximation framework to effectively optimize the network connectivity Lastly the book discusses the new research

frontiers and directions to explore for network connectivity studies This book is an accessible introduction to the study of connectivity in complex networks It is essential reading for advanced undergraduates Ph D students as well as researchers and practitioners who are interested in graph mining data mining and machine learning **Sharing Network Resources** Abhey Parekh,Jean Walrand,2022-06-01 Resource Allocation lies at the heart of network control In the early days of the Internet the scarcest resource was bandwidth but as the network has evolved to become an essential utility in the lives of billions the nature of the resource allocation problem has changed This book attempts to describe the facets of resource allocation that are most relevant to modern networks It is targeted at graduate students and researchers who have an introductory background in networking and who desire to internalize core concepts before designing new protocols and applications We start from the fundamental question what problem does network resource allocation solve This leads us in Chapter 1 to examine what it means to satisfy a set of user applications that have different requirements of the network and to problems in Social Choice Theory We find that while capturing these preferences in terms of utility is clean and rigorous there are significant limitations to this choice Chapter 2 focuses on sharing divisible resources such as links and spectrum Both of these resources are somewhat atypical a link is most accurately modeled as a queue in our context but this leads to the analytical intractability of queueing theory and spectrum allocation methods involve dealing with interference a poorly understood phenomenon Chapters 3 and 4 are introductions to two allocation workhorses auctions and matching In these chapters we allow the users to game the system i e to be strategic but don t allow them to collude In Chapter 5 we relax this restriction and focus on collaboration Finally in Chapter 6 we discuss the theoretical yet fundamental issue of stability Here our contribution is mostly on making a mathematically abstruse subdiscipline more accessible without losing too much generality Wireless Network Pricing Jianwei Huang,Lin Gao,2022-06-01 Today s wireless communications and networking practices are tightly coupled with economic considerations to the extent that it is almost impossible to make a sound technology choice without understanding the corresponding economic implications This book aims at providing a foundational introduction on how microeconomics and pricing theory in particular can help us to understand and build better wireless networks The book can be used as lecture notes for a course in the field of network economics or a reference book for wireless engineers and applied economists to understand how pricing mechanisms influence the fast growing modern wireless industry This book first covers the basics of wireless communication technologies and microeconomics before going in depth about several pricing models and their wireless applications The pricing models include social optimal pricing monopoly pricing price differentiation oligopoly pricing and network externalities supported by introductory discussions of convex optimization and game theory The wireless applications include wireless video streaming service provider competitions cellular usage based pricing network partial price differentiation wireless spectrum leasing distributed power control and cellular technology upgrade More information related to the book including references slides and videos can be

found at ncel ie cuhk edu hk content wireless network pricing   Optimal Path Problems in Networks Yü-yüan Chʻin,1992

The Robust Shortest Path Problem in Layered Networks Gang Yu,University of Texas at Austin. Department of Management Science and Information Systems,1994   **Shortest Path Routing Problem in Networks and Optimization Algorithms** Kulvir Kaur,2012 Various intelligent techniques were used to solve the Shortest Path Problems in the Networks like Artificial Neural Networks ANN Genetic Algorithms GA Particle Swarm Optimization PSO etc With the recent up gradation in wireless technology mobile communication between various nodes has become possible One of the most important characteristics in mobile wireless networks is the topology dynamics the network topology keeps on changing due to energy conservation or node mobility Therefore the shortest path routing problem becomes a Dynamic Optimization Problem DOP in Mobile Networks Here the use of various optimization algorithms to solve the dynamic shortest path problem in Mobile Networks and their comparisons are discussed   **Shortest path network problems** Jin Y. Yen,1975

Path Queries and Data Collection in Geometric Networks Radwa El Shawi,2013 The shortest path problem is one of the most fundamental and well studied problems in graph theory Numerous real world applications have stimulated research investigations for more than 50 years Finding routes in road networks is a classical application motivating the study of the shortest path problem The aim of this book is to provide means to efficiently compute a minimum cost path in different types of problem settings We consider three different settings all with an underlying metric space transportation networks anisotropic media and wireless sensor networks The first part of the book focuses on the construction of a data structure that allows for efficient approximate quickest path cost queries in a transportation network In the second part of the book we study the minimum cost path problem in an environment in which the cost is direction dependent anisotropic We present an approximation algorithm to find a minimum cost path for a point robot moving in a planar subdivision in which each face is assigned a translational flow that reflects the cost of travelling within this face The final part is about Wireless Sensor Networks with Mobile Elements WSNME   **Optimal Decomposition of Large-scale Networks** Jang Gyu Lee,1977

Constrained Shortest Paths and Related Problems Mark Ziegelmann,2007-12-01 The shortest path problem arises in various applied settings where some material e g computer data packet telephone calls vehicles is sent between two specified points in a network as quickly cheaply or reliably as possible In practice we want to optimize a combination of those criteria i e we have a bi or multicriteria shortest path problem This book proposes a 2 step method for the constrained shortest path problem A relaxation is solved to get upper and lower bounds and then the gap is closed with clever path ranking to obtain the exact solution Different old and new methods are compared both theoretically and experimentally The proposed 2 step method also works for a more general class of constrained network optimization problems In addition the generic approach is illustrated with several examples and a newly developed Constrained Network Optimization Software Package CNOP is introduced that provides this generic 2 step approach as well as all state of the art algorithms for constrained shortest paths

This book is a valuable resource for researchers students as well as practitioners working on the constrained shortest path problem and related problems   *Path Selection Problem in Network Design* Xueying Shen,2014 In this thesis we study several models for the Path Selection Problem associated with the construction of fibre optic networks Four different variations of the problem are studied Greedy Path Selection Problem GPSP Benevolent Path Selection Problem BPSP Discounted Path Selection Problem DPSP and Path Selection with capacity expansion EPSP All the variations are NP hard and polynomially solvable special cases are identified for GPSP and BPSP We also present detailed complexity analysis and integer programming formulations for these problems Heuristic algorithms including greedy algorithm semi greedy algorithm and multi start local search algorithm are developed for each problem Extensive computational results are provided with the algorithm performance analysis We also present some future directions for research   **The Shortest-Path Problem** Hector Ortega-Arranz,Diego R. Llanos,Arturo Gonzalez-Escribano,2014-12-01 Many applications in different domains need to calculate the shortest path between two points in a graph In this paper we describe this shortest path problem in detail starting with the classic Dijkstra s algorithm and moving to more advanced solutions that are currently applied to road network routing including the use of heuristics and precomputation techniques Since several of these improvements involve subtle changes to the search space it may be difficult to appreciate their benefits in terms of time or space requirements To make methods more comprehensive and to facilitate their comparison this book presents a single case study that serves as a common benchmark The paper also compares the search spaces explored by the methods described both from a quantitative and qualitative point of view and including an analysis of the number of reached and settled nodes by different methods for a particular topology   **Neural Networks for Dynamic Shortest Path Routing Problems - A Survey** Dr. K. Duraiswamy,R. Nallusamy,2011 This paper reviews the overview of the dynamic shortest path routing problem and the various neural networks to solve it Different shortest path optimization problems can be solved by using various neural networks algorithms The routing in packet switched multi hop networks can be described as a classical combinatorial optimization problem i e a shortest path routing problem in graphs The survey shows that the neural networks are the best candidates for the optimization of dynamic shortest path routing problems due to their fastness in computation comparing to other softcomputing and metaheuristics algorithms   *Interconnection Networks and the K-disjoint Path Problem* Lazaros D. Kikas,2004   *Dynamic Shortest Paths Minimizing Travel Times and Costs* ,2001   **The Maximum Covering/shortest Path Problem** John Richard Current,Charles ReVelle,Jared L. Cohon,1983   **Shortest Path Networks, Varying the Length of an Arc and Removing and Adding Arcs** R. Hartley,1978

Path Problems In Networks George Theodorakopoulos Book Review: Unveiling the Magic of Language

In an electronic digital era where connections and knowledge reign supreme, the enchanting power of language has be much more apparent than ever. Its power to stir emotions, provoke thought, and instigate transformation is truly remarkable. This extraordinary book, aptly titled "**Path Problems In Networks George Theodorakopoulos**," compiled by a highly acclaimed author, immerses readers in a captivating exploration of the significance of language and its profound affect our existence. Throughout this critique, we will delve in to the book is central themes, evaluate its unique writing style, and assess its overall influence on its readership.

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