Data Networks Gallager Solution Manual

This textbook takes a unified view of the fundamentals of wireless communication and explains cutting-edge concepts in a simple and intuitive way. An abundant supply of exercises make it ideal for graduate courses in electrical and computer engineering and it will also be of great interest to practising engineers.

This book concerns digital communication. Specifically, we treat the transport of bit streams from one geographical location to another over various physical media, such as wire pairs, coaxial cable, optical fiber, and radio waves. Further, we cover the mul tiplexing, multiple access, and synchronization issues relevant to constructing com munication networks that simultaneously transport bit streams from many users. The material in this book is thus directly relevant to the design of a multitude of digital communication systems, including for example local and metropolitan area data net works, voice and video telephony systems, the integrated services digital network (ISDN), computer communication systems, voiceband data modems, and satellite communication systems. We extract the common principles underlying these and other applications and present them in a unified framework. This book is intended for designers and would-be designers of digital communication systems. To limit the scope to manageable proportions we have had to be selective in the topics covered and in the depth of coverage. In the case of advanced information, coding, and detection theory, for example, we have not tried to duplicate the in-depth coverage of many advanced textbooks, but rather have tried to cover those aspects directly relevant to the design of digital communication systems.

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Queueing analysis is a vital tool used in the evaluation of system performance. Applications of queueing analysis cover a wide spectrum from bank automated teller machines to transportation and communications data networks. Fully revised, this second edition of a popular book contains the significant addition of a new chapter on Flow & Congestion Control and a section on Network Calculus among other new sections that have been added to remaining chapters. An introductory text, Queueing Modelling Fundamentals focuses on queueing modelling techniques and applications of data networks, examining the underlying principles of isolated queueing systems. This book introduces the complex queueing theory in simple language/proofs to enable the reader to quickly pick up an overview to queueing theory without utilizing the diverse necessary mathematical tools. It incorporates a rich set of worked examples on its applications to communication networks. Features include: Fully revised and updated edition with significant new chapter on Flow and Congestion Control as-well-as a new section on Network Calculus A comprehensive text which highlights both the theoretical models and their applications through a rich set of worked examples, examples of applications to data networks and performance curves Provides an insight into the underlying queuing principles and features step-by-step derivation of queueing results Written by experienced Professors in the field Queueing Modelling Fundamentals is an introductory text for undergraduate or entry-level post-graduate students who are taking courses on network performance analysis as well as those practicing network administrators who want to understand the essentials of network operations. The detailed step-by-step derivation of queueing results also makes it an excellent text for professional engineers.

This definitive textbook provides a solid introduction to discrete and continuous stochastic processes, tackling a complex field in a way that instils a deep understanding of the relevant mathematical principles, and develops an intuitive grasp of the way these principles can be applied to modelling real-world systems. It includes a careful review of elementary probability and detailed coverage of Poisson, Gaussian and Markov processes with richly varied queuing applications. The theory and applications of inference, hypothesis testing, estimation, random walks, large deviations, martingales and investments are developed. Written by one of the world's leading information theorists, evolving over twenty years of graduate classroom teaching and enriched by over 300 exercises, this is an exceptional resource for anyone looking to develop their understanding of stochastic processes.

Analytical techniques for evaluating the performance of computer and communication systems have evolved hand in hand with the progress in these systems since the late 1960's, and an enormous amount of knowledge has been accumulated in this interplay of applied mathematics and computer science. This book includes nineteen lengthy surveys of the state of the art of performance evaluation techniques, and an extensive bibliography. The topics include stochastic processes and queueing theory applied to performance analysis, and performance models of computer systems and communication networks. Articles have been contributed by leading scientists from five continents.

An effective blend of carefully explained theory and practical applications, this text imparts the fundamentals of both information theory and data compression. Although the two topics are related, this unique text allows either topic to be presented independently, and it was specifically designed so that the data compression section requires no prior knowledge of information theory. The treatment of information theory, while theoretical and abstract, is quite elementary, making this text less daunting than many others. After presenting the fundamental definitions and results of the theory, the authors then apply the theory to memoryless, discrete channels with zeroth-order, one-state sources. The chapters on data compression acquaint students with a myriad of lossless compression methods and then introduce two lossy compression methods. Students emerge from this study competent in a wide range of techniques. The authors' presentation is highly practical but includes some important proofs, either in the text or in the exercises, so instructors can, if they choose, place more emphasis on the mathematics. Introduction to Information Theory and Data Compression, Second Edition is ideally suited for an upper-level or graduate course for students in mathematics, engineering, and computer science. Features: Expanded discussion of the historical and theoretical basis of information theory that builds a firm, intuitive grasp of the subject Reorganization of theoretical results along with new exercises, ranging from the routine to the more difficult, that reinforce students' ability to apply the definitions and results in specific situations. Simplified treatment of the algorithm(s) of Gallager and Knuth Discussion of the information rate of a code and the trade-off between error correction and information rate Treatment of probabilistic finite state source automata, including basic results, examples, references, and exercises Octave and MATLAB image compression codes included in an appendix for use with the exercises and projects involving transform methods Supplementary materials, including software, available for download from the authors' Web site at www.dms.auburn.edu/compression

Mathematics as a production factor or driving force for innovation? Those, who want to know and understand why mathematics is deeply involved in the design of products, the layout of production processes and supply chains will find this book an indispensable and rich source. Describing the interplay between mathematical and engineering sciences the book focusses on questions like How can mathematics improve to the improvement of technological processes and products? What is happening already? Where are the deficits? What can we expect for the future? 19 articles written by mixed teams of authors of engineering, industry and mathematics offer a fascinating insight of the interaction between mathematics and engineering.

"To design future networks that are worthy of society's trust, we must put the 'discipline' of computer networking on a much stronger foundation. This book rises above the considerable minutiae of today's networking technologies to emphasize the long-standing mathematical underpinnings of the field." -Professor Jennifer Rexford, Department of Computer Science, Princeton University "This book is exactly the one I have been waiting for the last couple of years. Recently, I decided most students were already very familiar with the way the net works but were not being taught the fundamentals-the math. This book contains the knowledge for people who will create and understand future communications systems." -Professor Jon Crowcroft, The Computer

Laboratory, University of Cambridge The Essential Mathematical Principles Required to Design, Implement, or Evaluate Advanced Computer Networks Students, researchers, and professionals in computer networking require a firm conceptual understanding of its foundations. Mathematical Foundations of Computer Networking provides an intuitive yet rigorous introduction to these essential mathematical principles and techniques. Assuming a basic grasp of calculus, this book offers sufficient detail to serve as the only reference many readers will need. Each concept is described in four ways: intuitively; using appropriate mathematical notation; with a numerical example carefully chosen for its relevance to networking; and with a numerical exercise for the reader. The first part of the text presents basic concepts, and the second part introduces four theories in a progression that has been designed to gradually deepen readers' understanding. Within each part, chapters are as self-contained as possible. The first part covers probability; statistics; linear algebra; optimization; and signals, systems, and transforms. Topics range from Bayesian networks to hypothesis testing, and eigenvalue computation to Fourier transforms. These preliminary chapters establish a basis for the four theories covered in the second part of the book: queueing theory, game theory, control theory, and information theory. The second part also demonstrates how mathematical concepts can be applied to issues such as contention for limited resources, and the optimization of network responsiveness, stability, and throughput.

Providing the underlying principles of digital communication and the design techniques of real-world systems, this textbook prepares senior undergraduate and graduate students for the engineering practices required in industry. Covering the core concepts, including modulation, demodulation, equalization, and channel coding, it provides step-by-step mathematical derivations to aid understanding of background material. In addition to describing the basic theory, the principles of system and subsystem design are introduced, enabling students to visualize the intricate connections between subsystems and understand how each aspect of the design supports the overall goal of achieving reliable communications. Throughout the book, theories are linked to practical applications with over 250 real-world examples, whilst 370 varied homework problems in three levels of difficulty enhance and extend the text material. With this textbook, students can understand how digital communication systems operate in the real world, learn how to design subsystems, and evaluate end-to-end performance with ease and confidence.

This book is an evolution from my book A First Course in Information Theory published in 2002 when network coding was still at its infancy. The last few years have witnessed the rapid development of network coding into a research ?eld of its own in information science. With its root in infor- tion theory, network coding has not only brought about a paradigm shift in network communications at large, but also had signi?cant in?uence on such speci?c research ?elds as coding theory, networking, switching, wireless c- munications,distributeddatastorage,cryptography,andoptimizationtheory. While new applications of network coding keep emerging, the fundamental - sults that lay the foundation of the subject are more or less mature. One of the main goals of this book therefore is to present these results in a unifying and coherent manner. While the previous book focused only on information theory for discrete random variables, the current book contains two new chapters on information theory for continuous random variables, namely the chapter on di?erential entropy and the chapter on continuous-valued channels. With these topics included, the book becomes more comprehensive and is more suitable to be used as a textbook for a course in an electrical engineering department.

Based on the popular Artech House classic, Digital Communication Systems Engineering with Software-Defined Radio, this book provides a practical approach to quickly learning the software-defined radio (SDR) concepts needed for work in the field. This up-to-date volume guides readers on how to quickly prototype wireless designs using SDR for real-world testing and experimentation. This book explores advanced wireless communication techniques such as OFDM, LTE, WLA, and hardware targeting. Readers will gain an understanding of the core concepts behind wireless hardware, such as the radio frequency front-end, analog-to-digital and digital-to-analog converters, as well as various processing technologies. Moreover, this volume includes chapters on timing estimation, matched filtering, frame synchronization message decoding, and source coding. The orthogonal frequency division multiplexing is explained and details about HDL code generation and deployment are provided. The book concludes with coverage of the WLAN toolbox with OFDM beacon reception and the LTE toolbox with downlink reception. Multiple case studies are provided throughout the book. Both MATLAB and Simulink source code are included to assist readers with their projects in the field.

This highly acclaimed work, first published by Prentice Hall in 1989, is a comprehensive and theoretically sound treatment of parallel and distributed numerical methods. It focuses on algorithms that are naturally suited for massive parallelization, and it explores the fundamental convergence, rate of convergence, communication, and synchronization issues associated with such algorithms. This is an extensive book, which aside from its focus on parallel and distributed algorithms, contains a wealth of material on a broad variety of computation and optimization topics. It is an excellent supplement to several of our other books, including Convex Optimization Algorithms (Athena Scientific, 2015), Nonlinear Programming (Athena Scientific, 1999), Dynamic Programming and Optimal Control (Athena Scientific, 2012), Neuro-Dynamic Programming (Athena Scientific, 1996), and Network Optimization (Athena Scientific, 1998). The on-line edition of the book contains a 95-page solutions manual.

Stochastic processes are found in probabilistic systems that evolve with time. Discrete stochastic processes change by only integer time steps (for some time scale), or are characterized by discrete occurrences at arbitrary times. Discrete Stochastic Processes helps the reader develop the understanding and intuition necessary to apply stochastic process theory in engineering, science and operations research. The book approaches the subject via many simple examples which build insight into the structure of stochastic processes and the general effect of these phenomena in real systems. The book presents mathematical ideas without recourse to measure theory, using only minimal mathematical analysis. In the proofs and explanations, clarity is favored over formal rigor, and simplicity over generality. Numerous examples are given to show how results fail to hold when all the conditions are not satisfied. Audience: An excellent textbook for a graduate level course in engineering and operations research. Also an invaluable reference for all those requiring a deeper understanding of the subject.

Wireless technology is a truly revolutionary paradigm shift, enabling multimedia communications between people and devices from any location. It also underpins exciting applications such as sensor networks, smart homes, telemedicine, and automated highways. This book provides a comprehensive introduction to the underlying theory, design techniques and analytical tools of wireless communications, focusing primarily on the core principles of wireless system design. The book begins with an overview of wireless systems and standards. The characteristics of the wireless channel are then described, including their fundamental capacity limits. Various modulation, coding, and signal processing schemes are then discussed in detail, including state-of-the-art adaptive modulation, multicarrier, spread spectrum, and multiple antenna techniques. The concluding chapters deal with multiuser communications, cellular system design, and ad-hoc network design. Design insights and tradeoffs are emphasized throughout the

book. It contains many worked examples, over 200 figures, almost 300 homework exercises, over 700 references, and is an ideal textbook for students.

Original textbook (c) October 31, 2011 by Olivier Bonaventure, is licensed under a Creative Commons Attribution (CC BY) license made possible by funding from The Saylor Foundation's Open Textbook Challenge in order to be incorporated into Saylor's collection of open courses available at: http: //www.saylor.org. Free PDF 282 pages at https: //www.textbookequity.org/bonaventure-computer-networking-principles-protocols-and-practice/ This open textbook aims to fill the gap between the open-source implementations and the open-source network specifications by providing a detailed but pedagogical description of the key principles that guide the operation of the Internet. 1 Preface 2 Introduction 3 The application Layer 4 The transport layer 5 The network layer 6 The datalink layer and the Local Area Networks 7 Glossary 8 Bibliography

This volume is designed to develop an understanding of data networks and evolving integrated networks, and to explore evolving integrated networks and the various analysis and design tools. It begins with an overview of the principles behind data networks, then develops an understanding of the modelling issues and mathematical analysis needed to compare the effectiveness of different networks.

As customers migrate en masse from private lines to frame relay/ATM technologies, the need for effective multi-protocol wide-area networks increases dramatically. With this new book, network designers and engineers get the help they need to ensure that hardware, software, and data transport devices deliver the expected level of performance in this challenging environment.

Computer communication networks have come of age. Today, there is hardly any professional, particularly in engineering, that has not been the user of such a network. This proliferation requires the thorough understanding of the behavior of networks by those who are responsible for their operation as well as by those whose task it is to design such networks. This is probably the reason for the large number of books, monographs, and articles treating relevant issues, problems, and solutions in this field. Among all computer network architectures, those based on broadcast mul tiple access channels stand out in their uniqueness. These networks appear naturally in environments requiring user mobility where the use of any fixed wiring is impossible and a wireless channel is the only available option. Because of their desirable characteristics multiple access networks are now used even in environments where a wired point-to-point network could have been installed. The understanding of the operation of multiple access network through their performance analysis is the focus of this book.

The latest edition of this classic is updated with new problem sets and material The Second Edition of this fundamental textbook maintains the book's tradition of clear, thought-provoking instruction. Readers are provided once again with an instructive mix of mathematics, physics, statistics, and information theory. All the essential topics in information theory are covered in detail, including entropy, data compression, channel capacity, rate distortion, network information theory, and hypothesis testing. The authors provide readers with a solid understanding of the underlying theory and applications. Problem sets and a telegraphic summary at the end of each chapter further assist readers. The historical notes that follow each chapter recap the main points. The Second Edition features: * Chapters reorganized to improve teaching * 200 new problems * New material on source coding, portfolio theory, and feedback capacity * Updated references Now current and enhanced, the Second Edition of Elements of Information Theory remains the ideal textbook for upper-level undergraduate and graduate courses in electrical engineering, statistics, and telecommunications.

What every electrical engineering student and technical professional needs to know about data exchange across networks While most electrical engineering students learn how the individual components that make up data communication technologies work, they rarely learn how the parts work together in complete data communication networks. In part, this is due to the fact that until now there have been no texts on data communication networking written for undergraduate electrical engineering students. Based on the author's years of classroom experience, Fundamentals of Data Communication Networks fills that gap in the pedagogical literature, providing readers with a much-needed overview of all relevant aspects of data communication networking, addressed from the perspective of the various technologies involved. The demand for information exchange in networks continues to grow at a staggering rate, and that demand will continue to mount exponentially as the number of interconnected IoT-enabled devices grows to an expected twenty-six billion by the year 2020. Never has it been more urgent for engineering students to understand the fundamental science and technology behind data communication, and this book, the first of its kind, gives them that understanding. To achieve this goal, the book: Combines signal theory, data protocols, and wireless networking concepts into one text Explores the full range of issues that affect common processes such as media downloads and online games Addresses services for the network layer, the transport layer, and the application layer Investigates multiple access schemes and local area networks with coverage of services for the physical layer and the data link layer Describes mobile communication networks and critical issues in network security Includes problem sets in each chapter to test and fine-tune readers' understanding Fundamentals of Data Communication Networks is a must-read for advanced undergraduates and graduate students in electrical and computer engineering. It is also a valuable working resource for researchers, electrical engineers, and technical professionals.

Communication networks underpin our modern world, and provide fascinating and challenging examples of large-scale stochastic systems. Randomness arises in communication systems at many levels: for example, the initiation and termination times of calls in a telephone network, or the statistical structure of the arrival streams of packets at routers in the Internet. How can routing, flow control and connection acceptance algorithms be designed to work well in uncertain and random environments? This compact introduction illustrates how stochastic models can be used to shed light on important issues in the design and control of communication networks. It will appeal to readers with a mathematical background wishing to understand this important area of application, and to those with an engineering background who want to grasp the underlying mathematical theory. Each chapter ends with exercises and suggestions for further reading.

An overview of the rapidly growing field of ant colony optimization that describes theoretical findings, the major algorithms, and current applications. The complex social behaviors of ants have been much studied by science, and computer scientists are now finding that these behavior patterns can provide models for solving difficult combinatorial optimization problems. The attempt to develop algorithms inspired by one aspect of ant behavior, the ability to find what computer scientists would call shortest paths, has become the field of ant colony optimization (ACO), the most successful and widely recognized algorithmic technique based on ant behavior. This book presents an overview of this rapidly

growing field, from its theoretical inception to practical applications, including descriptions of many available ACO algorithms and their uses. The book first describes the translation of observed ant behavior into working optimization algorithms. The ant colony metaheuristic is then introduced and viewed in the general context of combinatorial optimization. This is followed by a detailed description and guide to all major ACO algorithms and a report on current theoretical findings. The book surveys ACO applications now in use, including routing, assignment, scheduling, subset, machine learning, and bioinformatics problems. AntNet, an ACO algorithm designed for the network routing problem, is described in detail. The authors conclude by summarizing the progress in the field and outlining future research directions. Each chapter ends with bibliographic material, bullet points setting out important ideas covered in the chapter, and exercises. Ant Colony Optimization will be of interest to academic and industry researchers, graduate students, and practitioners who wish to learn how to implement ACO algorithms.

This text introduces engineering students to probability theory and stochastic processes. Along with thorough mathematical development of the subject, the book presents intuitive explanations of key points in order to give students the insights they need to apply math to practical engineering problems. The first seven chapters contain the core material that is essential to any introductory course. In one-semester undergraduate courses, instructors can select material from the remaining chapters to meet their individual goals. Graduate courses can cover all chapters in one semester.

Appropriate for Computer Networking or Introduction to Networking courses at both the undergraduate and graduate level in Computer Science, Electrical Engineering, CIS, MIS, and Business Departments. Tanenbaum takes a structured approach to explaining how networks work from the inside out. He starts with an explanation of the physical layer of networking, computer hardware and transmission systems; then works his way up to network applications. Tanenbaum's in-depth application coverage includes email; the domain name system; the World Wide Web (both client- and server-side); and multimedia (including voice over IP, Internet radio video on demand, video conferencing, and streaming media.

The renowned communications theorist Robert Gallager brings his lucid writing style to the study of the fundamental system aspects of digital communication for a one-semester course for graduate students. With the clarity and insight that have characterized his teaching and earlier textbooks, he develops a simple framework and then combines this with careful proofs to help the reader understand modern systems and simplified models in an intuitive yet precise way. A strong narrative and links between theory and practice reinforce this concise, practical presentation. The book begins with data compression for arbitrary sources. Gallager then describes how to modulate the resulting binary data for transmission over wires, cables, optical fibers, and wireless channels. Analysis and intuitive interpretations are developed for channel noise models, followed by coverage of the principles of detection, coding, and decoding. The various concepts covered are brought together in a description of wireless communication, using CDMA as a case study.

Although there are many books available on WSNs, most are low-level, introductory books. The few available for advanced readers fail to convey the breadth of knowledge required for those aiming to develop next-generation solutions for WSNs.Filling this void, Wireless Sensor Networks: From Theory to Applications supplies comprehensive coverage of WS

This book surveys state-of-the-art optimization modeling for design, analysis, and management of wireless networks, such as cellular and wireless local area networks (LANs), and the services they deliver. The past two decades have seen a tremendous growth in the deployment and use of wireless networks. The current-generation wireless systems can provide mobile users with high-speed data services at rates substantially higher than those of the previous generation. As a result, the demand for mobile information services with high reliability, fast response times, and ubiquitous connectivity continues to increase rapidly. The optimization of system performance has become critically important both in terms of practical utility and commercial viability, and presents a rich area for research. In the editors' previous work on traditional wired networks, we have observed that designing low cost, survivable telecommunication networks involves extremely complicated processes. Commercial products available to help with this task typically have been based on simulation and/or proprietary heuristics. As demonstrated in this book, however, mathematical programming deserves a prominent place in the designer's toolkit. Convenient modeling languages and powerful optimization solvers have greatly facilitated the implementation of mathematical programming theory into the practice of commercial network design. These points are equally relevant and applicable in today's world of wireless network technology and design. But there are new issues as well: many wireless network design decisions, such as routing and facility/element location, must be dealt with in innovative ways that are unique and distinct from wired (fiber optic) networks. The book specifically treats the recent research and the use of modeling languages and network optimization techniques that are playing particularly important and distinctive roles in the wireless domain.

This comprehensive treatment of network information theory and its applications provides the first unified coverage of both classical and recent results. With an approach that balances the introduction of new models and new coding techniques, readers are guided through Shannon's point-to-point information theory, single-hop networks, multihop networks, and extensions to distributed computing, secrecy, wireless communication, and networking. Elementary mathematical tools and techniques are used throughout, requiring only basic knowledge of probability, whilst unified proofs of coding theorems are based on a few simple lemmas, making the text accessible to newcomers. Key topics covered include successive cancellation and superposition coding, MIMO wireless communication, network coding, and cooperative relaying. Also covered are feedback and interactive communication, capacity approximations and scaling laws, and asynchronous and random access channels. This book is ideal for use in the classroom, for self-study, and as a reference for researchers and engineers in industry and academia.

The International Conference on Networking (ICN 2005) was the fourth conf- ence in its series aimed at stimulating technical exchange in the emerging and important ?eld of networking. On behalf of the International Advisory C- mittee, it is our great pleasure to welcome you to the proceedings of the 2005 event. Networking faces dramatic changes due to the customer-centric view, the venue of the next generation networks paradigm, the push from ubiquitous n-

working,andthenewservicemodels.Despitelegacyproblems,whichresearchers and industry are still discovering and improving the state of the art, the ho- zon has revealed new challenges that some of the authors tackled through their submissions. InfactICN2005wasverywellperceivedbytheinternationalnetworkingc- munity. A total of 651 papers from more than 60 countries were submitted, from which 238 were accepted. Each paper was reviewed by several members of the Technical Program Committee. This year, the Advisory Committee revalidated various accepted papers after the reviews had been incorporated. We perceived a signi?cant improvement in the number of submissions and the quality of the submissions. TheICN2005programcoveredavarietyofresearchtopicsthatareofcurrent interest,startingwithGridnetworks,multicasting,TCPoptimizations,QoSand security, emergency services, and network resiliency. The Program Committee selected also three tutorials and invited speakers that addressed the latest - search results from the international industries and academia, and reports on ?ndings from mobile, satellite, and personal communications related to 3rd- and 4th-generation research projects and standardization.

A unified treatment of the vulnerabilities that exist in real-world network systems—with tools to identify synergies for mergers and acquisitions Fragile Networks: Identifying Vulnerabilities and Synergies in an Uncertain World presents a comprehensive study of network systems and the roles these systems play in our everyday lives. This book successfully conceptualizes, defines, and constructs mathematically rigorous, computer-based tools for the assessment of network performance and efficiency, along with robustness and vulnerability analysis. The result is a thorough exploration that promotes an understanding of the critical infrastructure of today's network systems, from congested urban transportation networks and supply chain networks under disruption to financial networks and the Internet. The authors approach the analyses by abstracting not only topological structures of networks, but also the behavior of network users, the demand for resources, the resulting flows, and the associated costs. Following an introduction to the fundamental methodologies and tools required for network analysis and network vulnerability, the book is organized into three self-contained parts: Part I—Network Fundamentals, Efficiency Measurement, and Vulnerability Analysis explores the theoretical and practical foundations for a new network efficiency measure in order to assess the importance of network components in various network systems. Methodologies for distinct decision-making behaviors are outlined, along with the tools for qualitative analysis, the algorithms for the computation of solutions, and a thorough discussion of the unified network efficient measure and network robustness with the unified measure. Part II—Applications and Extensions examines the efficiency changes and the associated cost increments after network components are eliminated or partially damaged. A discussion of the recently established connections between transportation networks and different critical networks is provided, which demonstrates how the new network measures and robustness indices can be applied to different supply chain, financial, and dynamic networks, including the Internet and electronic power networks. Part III—Mergers and Acquisitions, Network Integration, and Synergies reveals the connections between transportation networks and different network systems and quantifies the synergies associated with the network systems, from total cost reduction to environmental impact assessment. In the case of mergers and acquisitions, the focus is on supply chain networks. The authors outline a system-optimization perspective for supply chain networks and also formalize coalition formation using game theory with insights into the merger paradox. With its numerous network examples and real-world applications, Fragile Networks: Identifying Vulnerabilities and Synergies in an Uncertain World is an excellent book for courses in network science, transportation science, operations management, and financial networks at the upper-undergraduate and graduate levels. It is also a valuable reference for researchers and practitioners in the areas of applied mathematics, computer science, operations research, management science, finance, and economics, as well as industrial, systems, and civil engineering. Listen to Dr. Nagurney's podcast Supernetworks: Building Better Real and Virtual Highways at http://www.scienceofbetter.org/podcast/ .