R. Ravi

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Education

Ph. D.	Computer Science (1993), Brown University, Providence, Rhode Island. "Steiner Trees and Beyond: Approximation Algorithms for Network Design." (Philip Klein, Chair, Franco Preparata, Paris Kanellakis).
Sc. M.	Computer Science (1991), Brown University, Providence, Rhode Island.
B. Tech.	(Bachelor of Technology) Computer Science and Engineering (1989), Indian Institute of Technology, Madras, India.

Positions Held

7/06-	Carnegie Bosch Professor of Operations Research and Computer Science, Tepper School of Business, Carnegie Mellon
7/05-7/08	Associate Dean for Intellectual Strategy, Tepper School of Business, Carnegie Mellon
7/04-7/07	Director, Center for Analytical Research in Technology, Tepper School of Business, Carnegie Mellon
7/03-	Professor, Tepper School of Business, Carnegie Mellon
7/99 - 6/03	Associate Professor without Indefinite Tenure, Tepper School of Business, Carnegie Mellon
9/95 - 6/99	Assistant Professor, Tepper School of Business, Carnegie Mellon
9/94 - 8/95	Postdoctoral Fellow, DIMACS: NSF Science and Technology Center for Discrete Mathematics and Theoretical Computer Science, Department of Computer Science, Princeton University
9/93 - 8/94	Postdoctoral Fellow, Department of Computer Science, University of California at Davis

Other Positions

5/97 -	Courtesy Appointment, Computer Science Department, School of Computer Science, Carnegie Mellon
9/10 -	Courtesy Appointment, Ray and Stephanie Lane Center for Computational Biology, SCS, Carnegie Mellon
1-5/11	Visiting Professor, Research Institute for Mathematical Sciences, Kyoto University
6/10-8/10	Academic Visitor, Microsoft Research, Cambridge, MA
11/09	Academic Visitor, Microsoft Research, Redmond, WA
01-06/09	Visiting Professor, CMU-Qatar, Doha
11-12/08	Invited Fellow of the Japanese Society for the Promotion of Science, Research Institute in Mathematical Sciences, Kyoto University
6/01 - 6/04	Research Scientist, Los Alamos National Laboratories, NM
01-04/02	Academic Visitor, IBM Almaden Research Center, San Jose, CA
01-02/99	Academic Visitor, IBM Solutions Research Center, New Delhi, India
5/96,6/02	Visiting Scholar, Max-Planck Institute for Informatics, Saarbrücken, Germany

Consulting Assignments

07/07, 05/10	Microsoft Research, Redmond, WA
5/01	Center for Interactive Simulations, GSIA, CMU
5/95	Sandia National Laboratories, Albuquerque

Awards

9/97	BP Research Chair 1997-98 (Carnegie Mellon University)
6/96-5/2000	NSF CAREER Award (Theory of Computation)
5/94	Prize for outstanding research, Brown University Chapter of Sigma Xi
9/91-5/93	IBM Graduate Fellowship
6/85-5/89	National Talent Scholarship, Government of India

Program Committee Member

APPROX 2011	**Program Chair**, 14th International Workshop on Approximation Algorithms for Combinatorial Optimization Problems.
FST&TCS 2008	28th Foundations of Software Technology and Theoretical Computer Science Conference.
FOCS 2008	**Program Chair**, 49th Annual IEEE Symposium on Foundations of Computer Science.
LATIN 2008	8th Latin American Informatics Conference.
STOC 2006	38th ACM Symposium on Theory of Computing.
COCOON 2005	11th International Computing and Combinatorics Conference.

WADS 2003	8th Workshop on Algorithms and Data Structures.
SODA 2003	14th Annual ACM-SIAM Symposium on Discrete Algorithms.
FST&TCS 2002	22nd Foundations of Software Technology and Theoretical Computer Science Conference.
APPROX 2001	4th International Workshop on Approximation Algorithms for Combinatorial Optimization Problems.
COCOON 2001	7th International Computing and Combinatorics Conference.
FOCS 2000	41st Annual IEEE Symposium on Foundations of Computer Science.
ESA 2000	8th Annual European Symposium on Algorithms.
SWAT 2000	7th Scandinavian Workshop on Algorithm Theory.

Editorial Experience

12 -	Area Editor, *Operations Research*, Discrete Optimization Area.
04 -	Associate Editor, *ACM Transactions on Algorithms*.
04 -	Associate Editor, *Management Science*.
06 - 08	Associate Editor, *Operations Research*.
03 - 05	Associate Editor, *Networks*.
03	Associate Editor, *Journal of Algorithms*.

Grants and Contracts

Approximation algorithms for NP-hard problems in Networks and Biology
National Science Foundation CAREER Award
June 1996 - May 2000 ($ 200,000)
Role: Principal Investigator

Parallel Elimination Orders with Applications in Operations Research and Scientific Computing
National Science Foundation - cNPQ Collaborative Research Grant
July 1999 - June 2002 ($ 199,094)
Role: Senior Personnel
(with Profs. Gary Miller and Bruce Maggs, SCS, Carnegie Mellon)

Combining facility location and network design: models and methods
CMU Carnegie Bosch Institute Faculty Development Grant
Summer 2000 ($ 15,000)
Role: Principal Investigator

Combinatorial Optimization in Biology
Los Alamos National Labs Research Subcontract
Summer 2000 ($ 15,000)
Role: Principal Investigator

Graph-theoretic Approximation Algorithms

National Science Foundation
July 2001 - June 2004 ($ 207,317)
Role: Principal Investigator

ALADDIN: A center for ALgorithm ADaptation Dissemination and INtegration
National Science Foundation Information Technology Research Large Grant
September 2001 - August 2006 ($ 5,655,274)
Role: Co-Principal Investigator
(with Profs. Guy Blelloch, Lenore Blum, John Lafferty, Daniel Sleator, SCS, Carnegie Mellon, and Robert Tarjan, Computer Science Department, Princeton)

New Directions in Approximation Algorithms
National Science Foundation
September 2004 - August 2007 ($ 187,724)
Role: Principal Investigator

Generalizing Haplotype Models for Phylogenetics
National Science Foundation
July 2006 - June 2009 ($ 646,727)
Role: Co-Principal Investigator
(with Prof. Guy Blelloch, Computer Science Department and Prof. Russell Schwartz, Department of Biological Sciences, Carnegie Mellon University)

Approximation Algorithms for Network Optimization
National Science Foundation
September 2007 - August 2011 ($ 255,744)
Role: Principal Investigator

Modeling Sponsored Search Auctions
Google Research Award
September 2009 - August 2010 ($ 75,000)
Role: Co-Principal Investigator
(with Prof. Isaemin Hafalir, Carnegie Mellon University)

New Techniques for Graph-TSP
National Science Foundation
September 2011 - August 2012 ($ 99,277)
Role: Principal Investigator

Publications

Book

Iterative Methods in Combinatorial Optimization
with Lap Chi Lau and Mohit Singh
Cambridge Texts in Applied Mathematics, Cambridge University Press (May 2011)

Articles in refereed journals

(1) I. Hafilir, R. Ravi and A. Sayedi. A near Pareto optimal auction with budget constraints. *Games and Economic Behavior* 74(2): 699-708 (2012).

(2) V. Nagarajan and R. Ravi. Approximation Algorithms for Distance Constrained Vehicle Routing. *Networks* 59(2): 209-214 (2012).

(3) M-C. Tsai, G. E. Blelloch, R. Ravi and R. Schwartz. A Consensus Tree Approach For Reconstructing Human Evolutionary History and Detecting Population Substructure. *IEEE/ACM Trans. Comput. Biology Bioinform.*, **8(4)**: 918-928 (2011).

(4) A. Gupta, M. Pal, R. Ravi and Amitabh Sinha. Sampling and Cost-Sharing: Approximation Algorithms for Stochastic Optimization Problems. *SIAM Journal on Computing*, **40(5)**: 1361-1401 (2011).

(5) V. Nagarajan and R. Ravi. The Directed Orienteering Problem. *Algorithmica*, **60(4)**, 1017-1030 (2011).

(6) L. Genc-Kaya, V. Goyal and R. Ravi. An FPTAS for Minimizing the Product of Two Non-negative Linear Cost Functions. *Mathematical Programming A*, **126(2)**, 401-405 (2011).

(7) R. Ravi and Amitabh Sinha. Approximation Algorithms for Multicommodity Facility Location Problems. *SIAM J. on Disc. Math*, **24(2)**, 538-551 (2010).

(8) A. Gupta, M. Hajiyaghayi, V. Nagarajan and R. Ravi. Dial a Ride from k-forest. *ACM Transactions on Algorithms*, **6(2)**, (2010).

(9) H. Yildiz, W. Fairey and R. Ravi. Integrated optimization of customer and supplier logistics at Robert Bosch LLC. *European Journal of Operational Research*, **207(1)**, 456-464 (2010).

(10) V. Nagarajan, R. Ravi and M. Singh. Simpler Analysis of Extreme Points for Traveling Salesman and Survivable Network Design Problems. *Operations Research Letters*, **38(3)**, 156-160, (2010).

(11) A. Gupta, V. Nagarajan and R. Ravi. An Improved Approximation Algorithm for Requirement Cut. *Operations Research Letters*, **38(4)**, 322-325, (2010).

(12) Vineet Goyal and R. Ravi. A PTAS for Chance-Constrained Knapsack Problem with Random Item Sizes. *Operations Research Letters*, **38(3)**, 161-164, (2010).

(13) V. Nagarajan and R. Ravi. Approximation Algorithms for Requirement Cut on Graphs. *Algorithmica*, **56(2)**, 198-213 (2010).

(14) Alan M. Frieze, Jon M. Kleinberg, R. Ravi and Warren Debany. Line-of-Sight Networks. *Combinatorics, Probability & Computing* **18(1-2)**: 145-163 (2009).

(15) S. Sridhar, F. Lam, G. E. Blelloch, R. Ravi and R. Schwartz. Mixed Integer Programming for Maximum-Parsimony Phylogeny Inference. *IEEE/ACM Transactions on Computational Biology and Bioinformatics*, **5:3**, 323-331, 2008.

(16) Giuseppe Lancia, R. Ravi and Romeo Rizzi. Haplotyping for Disease Association: A Combinatorial Approach. *IEEE/ACM Transactions on Computational Biology and Bioinformatics*, **5:2**, 245-251, 2008.

(17) F. Sibel Salman, R. Ravi and John N. Hooker. Solving the Capacitated Local Access Network Design Problem. *INFORMS Journal on Computing*, **20:2**, 243-254, 2008.

(18) R. Ravi and A. Sinha. Approximating k-cuts using network strength as a Lagrangean relaxation. *European Journal of Operations Research*, **186:1**, 77-90, (2008).

(19) S. Sridhar, F. Lam, G. E. Blelloch, R. Ravi and R. Schwartz. Direct maximum parsimony phylogeny reconstruction from genotype data. *BMC Bioinformatics* **8:472**, 2007.

(20) Srinath Sridhar, Kedar Dhamdhere, Guy E. Blelloch, Eran Halperin, R. Ravi and Russell Schwartz. Algorithms for Efficient Near-Perfect Phylogenetic Tree Reconstruction in Theory and Practice. *IEEE/ACM Transactions on Computational Biology and Bioinformatics (TCBB)* **4(4)**, 2007.

(21) A. Gupta, R. Ravi and A. Sinha. LP Rounding Approximation Algorithms for Stochastic Network Design. *Mathematics of Operations Research* **32 (2)**,(2007).

(22) K. Dhamdhere, A. Gupta and R. Ravi. Approximation algorithms for minimizing average distortion. *Theory of Computing Systems*, Special issue dedicated to papers invited from the STACS 2004 conference, **39 (1)**, 2006: 93-111.

(23) R. Ravi and Amitabh Sinha. Hedging Uncertainty: Approximation Algorithms for Stochastic Optimization Problems. *Mathematical Programming A*, **108(1)**, 2006: 97-114.

(24) Shuchi Chawla, Uday Rajan, R. Ravi and Amitabh Sinha. Min-max Payoffs in a Two-Person Location Game. *Operations Research Letters*, **34(5)**, 2006: 499-507.

(25) R. Ravi and Amitabh Sinha. Approximation Algorithms for Problems Combining Facility Location and Network Design. *Operation Research*, **54 (1)**, 73-81 (2006).

(26) J. Könemann and R. Ravi. Primal-dual meets local search: approximating MST's with nonuniform degree bounds. *SIAM J. on Comp.*, **34 (3)**, 763-773 (2005).

(27) Philip N. Klein, Radha Krishnan, Balaji Raghavachari and R. Ravi. Approximation Algorithms for Finding Low-Degree Subgraphs. *Networks*, 203-215 (2004).

(28) Guy Even, Naveen Garg, Jochen Könemann, R. Ravi and Amitabh Sinha. Min-max Tree Covers of Graphs. *Operations Research Letters*, **32(4)**, 309, 315 (2004).

(29) E. Dahlhaus, P. Dankelmann and R. Ravi. A linear-time algorithms to compute a MAD tree of an interval graph. *Information Processing Letters*, **89(5)**, 255-259 (March 2004).

(30) Koen M.J. De Bontridder, Bjarni V. Halldrsson, Magnus M. Halldórsson, Cor A.J. Hurkens, Jan K. Lenstra, R. Ravi, and Leen Stougie. Approximation algorithms for the minimum test set problem. *Mathematical Programming*, **98**, 477-491 (2003).

(31) R. Hassin, R. Ravi and F. S. Salman. Approximation algorithms for a capacitated network design problem. *Algorithmica*, **38(3)**, 417-431 (2003).

(32) M. Conforti, R. Hassin and R. Ravi. Reconstructing edge-disjoint paths. *Operations Research Letters*, **31(4)**, 273-276 (2003).

(33) Jochen Könemann and R. Ravi. A Matter of Degree: Improved Approximation Algorithms for Degree-Bounded Minimum Spanning Trees. *SIAM Journal on Computing*, **31(6)**, 1783-1793 (2002).

(34) G. Konjevod, R. Ravi and A. Srinivasan. Approximation algorithms for the covering Steiner problem. *Random Structures and Algorithms*, **20:3**, 465-482, (2002).

(35) G. Konjevod, R. Ravi and F. S. Salman. On approximating planar metrics by tree metrics. *Information Processing Letters* **80(4)**, 213-219 (2001).

(36) R. Ravi, M. V. Marathe, S. S. Ravi, D. J. Rosenkrantz, and H. B. Hunt. Approximation Algorithms for Degree-Constrained Minimum-Cost Network-Design Problems. *Algorithmica*, **31:1**, 58-78 (2001).

(37) P. Keskinocak, R. Ravi and S. Tayur. Scheduling and Reliable Lead Time Quotation for Orders with Availability Intervals and Lead Time Sensitive Revenues. *Management Science*, **47:2**, 264-279, (February 2001).

(38) F. S. Salman, J. Cheriyan, R. Ravi, and S. Subramanian. Approximating the single-sink edge installation problem in network design. *SIAM Journal on Optimization*, **11:3**, 595-610 (2001).

(39) M. Dawande, J. Kalagnanam, P. Keskinocak, R. Ravi, F.S. Salman. Approximation Algorithms for the Multiple Knapsack Problem with Assignment Restrictions. *Journal of Combinatorial Optimization*, **4 (2)**, 171-186, (2000).

(40) N. Garg, G. Konjevod and R. Ravi. A polylogarithmic approximation algorithm for the group Steiner problem. *Journal of Algorithms*, **37**, 66-84 (2000).

(41) A. Blum, G. Konjevod, R. Ravi and S. Vempala. Semi-Definite Relaxations for Minimum Bandwidth and other Vertex-Ordering problems. *Theoretical Computer Science*, **235**, pp. 25-42 (2000). A preliminary version appeared in *Proceedings of the ACM Symposium on the Theory of Computing (STOC)*, 100-105 (1998).

(42) S. O. Krumke, M. V. Marathe, H. Noltemeier, R. Ravi, S. S. Ravi, R. Sundaram, H. C. Wirth. Improving minimum-cost spanning trees by upgrading nodes. *Journal of Algorithms*, **33:1**, 92-111 (1999). A preliminary version appeared in *Proceedings of the International Colloquium on Automata, Languages and Processing (ICALP)*, Springer-Verlag Lecture Notes in Computer Science 1256, 281-291 (1997).

(43) S. O. Krumke, H. Noltemeier, M. V. Marathe, R. Ravi, S. S. Ravi, R. Sundaram, H. C. Wirth. Improving spanning trees by upgrading nodes. *Theoretical Computer Science*, **221 (1-2)**, 139-155 (1999).

(44) B. Y. Wu, G. Lancia, V. Bafna, K-M. Chao, R. Ravi and C. Y. Tang. A polynomial-time approximation scheme for minimum routing cost spanning trees. *SIAM Journal on Computing*, **29:3**, pp. 761-778 (1999). A preliminary version appeared in *Proceedings of the ACM-SIAM Symposium on Discrete Algorithms (SODA)*, 21-32 (1998).

(45) A. Blum, R. Ravi and S. Vempala. A constant factor approximation algorithm for the k-MST problem. *J. Comp. Sys. Sci.* **58**, 101-108 (1999).

(46) S. O. Krumke, M. V. Marathe, H. Noltemeier, R. Ravi, S. S. Ravi. Approximation Algorithms for Certain Network Improvement Problems. *Journal of Combinatorial Optimization*, **2:2**, 257-288 (1998).

(47) R. Ravi and J. D. Kececioglu. Approximation algorithms for multiple sequence alignment under a fixed evolutionary tree. *Discrete Applied Mathematics* **88**, Special issue on Computational Molecular Biology, 355-366 (1998).

(48) Hsueh-I Lu and R. Ravi. Approximating maximum-leaf spanning trees in almost linear time. *Journal of Algorithms*, **29:1**, 132-141 (1998).

(49) M. V. Marathe, R. Ravi, R. Sundaram, S. S. Ravi, D. J. Rosenkrantz and H. B. Hunt. Bicriteria network design problems. *Journal of Algorithms*, **28:1**, 142-171 (1998).

(50) S. Chaudhuri, N. Garg, and R. Ravi. The p-neighbor k-center problem. *Information Processing Letters* **65**, 131-134 (1998).

(51) P. F. Stelling, C. U. Martel, V. G. Oklobdzija and R. Ravi. Optimal circuits for parallel multipliers. *IEEE Transactions on Computers* **47**, 273-286 (March 1998). A preliminary version appeared in *Proceedings of the IEEE Symposium on Computer Arithmetic*, 42-49 (1995).

(52) V. Bafna, B. Narayanan and R. Ravi. Nonoverlapping Local Alignments (Weighted independent sets of axis-parallel rectangles). *Discrete Applied Mathematics* **71**, Special issue on Computational Molecular Biology, 41-53 (1996).

(53) R. Ravi and D. P. Williamson. An approximation algorithm for minimum-cost vertex-connectivity problems. *Algorithmica* **18**, 21-34 (1997). An erratum appears in *Algorithmica* 34(1): 98-107 (2002).

(54) M. V. Marathe, R. Ravi and R. Sundaram. Service-constrained network design problems. *Nordic Journal of Computing* **3**, 367-387 (1996).

(55) R. Ravi, R. Sundaram, M. V. Marathe, S. S. Ravi, and D. J. Rosenkrantz. Spanning trees short or small. *SIAM Journal on Discrete Mathematics*, **9(2)** 178-200 (1996).

(56) P. Klein and R. Ravi. A nearly best-possible approximation algorithm for node-weighted Steiner trees. *Journal of Algorithms*, **19** 104-115 (1995).

(57) A. Agrawal, P. Klein, and R. Ravi. When trees collide : An approximation algorithm for the generalized Steiner problem on networks. *SIAM J. on Comp.*, **24(3)** 445-456 (1995).

(58) P. Klein, S. Rao, A. Agrawal, and R. Ravi. An approximate max-flow min-cut relation for multicommodity flow, with applications. *Combinatorica*, **15(2)** 187-202 (1995).

(59) R. Ravi. A primal-dual approximation algorithm for the Steiner forest problem. *Information Processing Letters* **50**, 185-190 (1994).

(60) R. Ravi, M. V. Marathe and C. Pandu Rangan. An optimal algorithm to solve the all-pair shortest path problem on interval graphs. *Networks*, **22**, 21-35 (1992).

(61) M. V. Marathe, R. Ravi and C. Pandu Rangan. Generalized vertex covering in interval graphs. *Discrete Applied Mathematics* **39**, 87-93 (1992).

Articles in refereed conference proceedings

(62) M. Molinaro and R. Ravi. Geometry of Online Packing Linear Programs. To appear, *Proc. of 39th International Colloquium on Automata, Languages and Programming*, (ICALP 2012).

(63) Niv Buchbinder, Joseph (Seffi) Naor, R. Ravi and Mohit Singh. Approximation Algorithms for Online Weighted Rank Function Maximization under Matroid Constraints. To appear, *Proc. of 39th International Colloquium on Automata, Languages and Programming*, (ICALP 2012).

(64) A. Gupta, R. Krishnaswamy, V. Nagarajan and R. Ravi. Approximation Algorithms for Stochastic Orienteering. *Proceedings of the ACM-SIAM Symposium on Discrete Algorithms (SODA)*, 1522-1538, (2012).

(65) A. Gupta, R. Krishnaswamy, M. Molinaro and R. Ravi. Approximation Algorithms for Correlated Knapsacks and Non-Martingale Bandits. *Proceedings of the 52nd Annual IEEE Symposium on Foundations of Computer Science (FOCS)*, 827-836 (2011).

(66) N. Misra, G. E. Blelloch, R. Ravi and R. Schwartz. An Optimization-Based Sampling Scheme for Phylogenetic Trees. *Proceedings of the 15th International Conference on Research in Computational Molecular Biology (RECOMB)*, 252-266 (2011).

(67) Inge Li Gørtz, Marco Molinaro, Viswanath Nagarajan and R Ravi. Capacitated Vehicle Routing with Non-uniform Speeds. *Proceedings of the 15th Conference on Integer Programming and Combinatorial Optimization (IPCO)*, 235-247, (2011).

(68) B. Meeder, B. Karrer, A. Sayedi, R. Ravi, C. Borgs and J. T. Chayes. We Know Who You Followed Last Summer: Inferring Social Link Creation Times in Twitter. *Proc. of 20th International Conference on World Wide Web*, (WWW 2011).

(69) C. Borgs, J. T. Chayes, B. Karrer, B. Meeder, R. Ravi, R. Reagans and A. Sayedi. Game-Theoretic Models of Information overload in Social Networks. *Proc. of 7th International Workshop on Algorithms and Models for the Web-Graph*, (WAW 2010).

(70) A. Gupta, V. Nagarajan and R. Ravi. Approximation Algorithms for Optimal Decision Trees and Adaptive TSP Problems. *Proc. of 37th International Colloquium on Automata, Languages and Programming*, 690-701, (2010).

(71) A. Gupta, V. Nagarajan and R. Ravi. Thresholded Covering Algorithms for Robust and Max-Min Optimization. *Proc. of 37th International Colloquium on Automata, Languages and Programming*, 262-274, (2010).

(72) N. Misra, G. E. Blelloch, R. Ravi and R. Schwartz. Generalized Buneman pruning for inferring the most parsimonious multi-state phylogeny. *Proceedings of the 14th International Conference on Research in Computational Molecular Biology (RECOMB)*, (2010).

(73) A. Gupta, R. Krishnaswamy and R. Ravi. Tree Embeddings for Two-Edge-Connected Network Design. *Proceedings of the ACM-SIAM Symposium on Discrete Algorithms (SODA)*, (2010).

(74) R. Ravi. Iterative Methods in Combinatorial Optimization (Invited Presentation). *Procedings of Conference on Foundations of Software Technology and Theoretical Computer Science (FST&TCS)*, 453-469 (2009).

(75) Inge Li Gørtz, Viswanath Nagarajan and R Ravi. Minimum Makespan Multi-vehicle Dial-a-Ride. *Proceedings of the European Symposium on Algorithms (ESA)*, (2009).

(76) Refael Hassin, R. Ravi and Fatma Sibel Salman. Tractable Cases of Facility Location on a Network with a Linear Reliability Order of Links. *Proceedings of the European Symposium on Algorithms (ESA)*, (2009).

(77) Fabrizio Grandoni, R. Ravi and Mohit Singh. Iterative Rounding for Multi-Objective Optimization Problems. *Proceedings of the European Symposium on Algorithms (ESA)*, (2009).

(78) A. Gupta, R. Krishnaswamy and R. Ravi. Online and Stochastic Survivable Network Design. *Proceedings of the ACM Symposium on the Theory of Computing (STOC)*, 685-694 (2009).

(79) V. Nagarajan and R. Ravi. The Directed Minimum Latency Problem. *Proceedings of the 11th International Workshop on Approximation Algorithms for Combinatorial Optimization Problems (APPROX)*, 193-206 (2008).

(80) V. Goyal, A. Gupta, S. Leonardi and R Ravi. Pricing Tree Access Networks with Connected Backbones. *Proceedings of the 15th Annual European Symposium on Algorithms (ESA)*, (2007).

(81) A. Gupta, J. Konemann, S. Leonardi, R. Ravi and G. Schaefer. An Efficient Cost-Sharing Mechanism for the Prize-Collecting Steiner Forest Problem. *Proceedings of the ACM-SIAM Symposium on Discrete Algorithms (SODA)*, (2007).

(82) Shuchi Chawla, Jason Hartline, Uday Rajan and R. Ravi. Bayesian Optimal No-Deficit Mechanism Design. *Proceedings of the Workshop on Internet and Network Economics (WINE)*, 2006: 136-148.

(83) V. Nagarajan and R. Ravi. Minimum Vehicle Routing with a Common Deadline. *Proceedings of the 9th International Workshop on Approximation Algorithms for Combinatorial Optimization Problems (APPROX)*, (2006).

(84) R. Ravi and Mohit Singh. Delegate and Conquer: An LP-based approximation algorithm for Minimum Degree MSTs. *Proc. of 33rd International Colloquium on Automata, Languages and Programming*, (ICALP 2006).

(85) R. Ravi. Matching Based Augmentations for Approximating Connectivity Problems. Invited Presentation, *Proceedings of LATIN 2006: Theoretical Informatics, 7th Latin American Symposium*, (2006).

(86) Daniel Golovin, Vineet Goyal and R. Ravi. Pay Today for a Rainy Day: Improved Approximation Algorithms for Demand-Robust Min-Cut and Shortest Path Problems. *Proceedings of the 23rd Annual Symposium on Theoretical Aspects of Computer Science (STACS)*, (2006).

(87) K. Dhamdhere, V. Goyal, R. Ravi and M. Singh. How to Pay, Come What May: Approximation Algorithms for Demand-Robust Covering Problems. *Proceedings of the 46th Annual IEEE Symposium on Foundations of Computer Science (FOCS)*, (2005).

(88) A. Gupta, M. Pal, R. Ravi and A. Sinha. What about Wednesday? Approximation Algorithms for Multistage Stochastic Optimization. *Proceedings of the 8th International Workshop on Approximation Algorithms for Combinatorial Optimization Problems (APPROX)*, (2005).

(89) Kedar Dhamdhere, R. Ravi and Mohit Singh. On Stochastic Minimum Spanning Trees. *Proceedings of the Conference on Integer Programming and Combinatorial Optimization (IPCO)*, (2005).

(90) Bruce M. Maggs, Gary L. Miller, Ojas Parekh, R. Ravi and Shan Leung Maverick Woo. Finding effective support-tree preconditioners. *Proceedings of the 17th Annual ACM Symposium on Parallel Algorithms (SPAA)*, (2005).

(91) M. Badoiu, K. Dhamdhere, A. Gupta, Y. Rabinovich, H. Raecke, R. Ravi and A. Sidiropoulos. Approximation Algorithms for Low-Distortion Embeddings Into Low-Dimensional Spaces. *Proceedings of the ACM-SIAM Symposium on Discrete Algorithms (SODA)*, (2005).

(92) V. Bilo, V. Goyal, R. Ravi and M. Singh. On the Crossing Spanning Tree Problem. *Proceedings of the 7th. International Workshop on Approximation Algorithms for Combinatorial Optimization Problems*, (2004).

(93) J. Könemann and R. Ravi. Quasi-Polynomial Time Approximation Algorithm for Low-Degree Minimum-Cost Steiner Trees. *Procedings of Conference on Foundations*

of Software Technology and Theoretical Computer Science (FST&TCS), LNCS 2914, 289-301 (2003).

(94) S. Chawla, D. Kitchin, U. Rajan, R. Ravi and A. Sinha. Profit guaranteeing mechanisms for multicast networks. *Proceedings of the ACM Conference on Electronic Commerce*, 190-191, (2003).

(95) Eduardo Laber, Ojas Parekh, and R. Ravi. Randomized Results for Query Optimization Problems on Two Processors. *Proceedings of the 10th Annual European Symposium on Algorithms (ESA)*, 646-661, (2002).

(96) Bjarni Halldórsson, J. S. Minden and R. Ravi. PIER: Protein Identification by Epitope Recognition. *Currents in Computational Molecular Biology 2001*, (N. El-Mabrouk and T. Lengauer and D. Sankoff, Eds.) 109-110 (2001).

(97) Naveen Garg, Rohit Khandekar, Goran Konjevod, R. Ravi, F.S. Salman and Amitabh Sinha. On the Integrality Gap of a Natural Formulation of the Single-Sink Buy-at-bulk Network Design Problem. *Proceedings of the Conference on Integer Programming and Combinatorial Optimization (IPCO)*, Springer-Verlag Lecture Notes in Computer Science 2081, 170-184 (2001).

(98) G. Lancia and R. Ravi. GESTALT: Genomic Steiner Alignments. *Proceedings of the 10th Annual Symposium on Combinatorial Pattern Matching (CPM),* LNCS 1645, 101-114 (1999).

(99) R. Ravi and F. S. Salman. Approximation Algorithms for the Traveling Purchaser Problem and its variants in network design. *Proceedings of the 7th Annual European Symposium on Algorithms (ESA),* Springer-Verlag Lecture Notes in Computer Science 1643, 29-40 (1999).

(100) J. Cheriyan, T. Jordan, and R. Ravi. On 2-coverings and 2-packings of laminar families. *Proceedings of the 7th Annual European Symposium on Algorithms (ESA),* Springer-Verlag Lecture Notes in Computer Science 1643, 510-520 (1999).

(101) C. Bornstein, B. Maggs, G. Miller and R. Ravi. Redeeming Nested Dissection: Parallelism Implies Fill. *Proceedings of the Ninth SIAM Conference on Parallel Processing for Scientific Computing*, San Antonio, Texas, USA, March 22-24, 1999. SIAM, 1999, CDROM.

(102) R. Carr and R. Ravi. A New Bound for the 2-Edge Connected Subgraph Problem. *Proceedings of the Conference on Integer Programming and Combinatorial Optimization (IPCO),* Springer-Verlag Lecture Notes in Computer Science 1412, 112-125 (1998).

(103) C. Bornstein, B. Maggs, G. Miller and R. Ravi. Parallel Gaussian elimination with linear fill. *Proceedings of IEEE Symposium on Foundations of Computer Science (FOCS)*, 274-283 (1997). A full version appears as technical report CMU-CS-97-133.

(104) A. Ben-Dor, G. Lancia, J. Perone and R. Ravi. Banishing bias from consensus sequences. *Proceedings of the 8th Annual Combinatorial Pattern Matching Conference (CPM)*, Springer-Verlag Lecture Notes in Computer Science 1264, 247-261 (1997).

(105) R. Ravi and M. X. Goemans. The constrained minimum spanning tree problem. *Proceedings of the 5th Scandinavian Workshop on Algorithms Theory (SWAT)*, Springer-Verlag Lecture Notes in Computer Science 1097, 66-75 (1996).

(106) V. Bafna, S. Muthukrishnan and R. Ravi. Computing similarity between RNA strings. *Proceedings of the 6th Annual Combinatorial Pattern Matching Conference (CPM)*, Springer-Verlag Lecture Notes in Computer Science 937, 1-16 (1995).

(107) J. D. Kececioglu and R. Ravi. Of mice and men: Evolutionary distances between genomes under translocations. *Proceedings of the ACM-SIAM Symposium on Discrete Algorithms (SODA)*, 604-613 (1995).

(108) R. Ravi. Rapid rumor ramification: Approximating the minimum broadcast time. *Proceedings of the IEEE Symposium on Foundations of Computer Science (FOCS)*, 202-213 (1994).

(109) P. Klein and R. Ravi. When cycles collapse: A general approximation technique for constrained two-connectivity problems. *Proceedings of the Conference on Integer Programming and Combinatorial Optimization (IPCO)*, 39-56 (1993).

(110) H.-I. Lu and R. Ravi. The power of local optimization: Approximation algorithms for maximum-leaf spanning tree. *30th Allerton Conference on Communications, Control and Computing*, 533-542 (1992).

(111) R. Ravi, A. Agrawal, and P. Klein. Ordering problems approximated: single-processor scheduling and interval graph completion. *International Colloquium on Automata, Languages and Processing (ICALP)*, Springer-Verlag Lecture Notes in Computer Science 510, 751-762 (1991).

Articles in edited books/volumes

(112) M. V. Marathe, R. Ravi and R. Sundaram. Improved results on service-constrained network design problems. *Network Design: Connectivity and Facilities Location*, edited by D. Z. Du and P. M. Pardalos, Vol. 40 in the DIMACS Series in Discrete Mathematics and Theoretical Computer Science, 269-276 (1998).

(113) S. O. Krumke, M. V. Marathe, H. Noltemeier, R. Ravi and S. S. Ravi. Network Improvement Problems. *Network Design: Connectivity and Facilities Location*, edited by D. Z. Du and P. M. Pardalos, Vol. 40 in the DIMACS Series in Discrete Mathematics and Theoretical Computer Science, 247-268 (1998).

(114) A. Agrawal, P. Klein, and R. Ravi. Cutting down on fill using nested dissection: provably good elimination orderings. Invited chapter, *Graph Theory and Sparse Matrix Computation*, edited by A. George, J. Gilbert, and J. W. H. Liu, Vol. 56 in the *IMA Volumes in Mathematics and its Applications*, Springer-Verlag (1993).

Professional Activities

Workshop (Co-)chair

10/09 Network Science, Carnegie Bosch Institute Conference, CMU.

06/08 Third Workshop on Flexible Network Design, University of Warwick, UK.

10/07 Hurdles to e-Business, Carnegie Bosch Institute Conference, CMU.

10/06 Second Workshop on Flexible Network Design, University of Bologna Residential Center at Betinoro, Italy.

11/05 Workshop on Flexible Network Design, ALADDIN Center, Princeton University.

10/05 FriezeFest, Workshop honoring Prof. Frieze on his 60th birthday, CMU.

05/05 Lamps of ALADDIN Annual Project Review, CMU.

10/04 Market Design Workshop, ALADDIN Center, CMU.

05/04 Lamps of ALADDIN Annual Project Review, CMU.

03/04 Integrated Logistics Workshop II, ALADDIN Center, Princeton University.

11/03 Workshop on Auction Theory and Practice, ALADDIN Center, CMU.

10/03 Integrated Logistics Workshop, ALADDIN Center, CMU.

5/98 DIMACS Workshop on Robust Communication Networks: Interconnection and Survivability, DIMACS Center, Rutgers University.

5/98 Joint DIMACS-CMU-Georgia Tech. Workshop on Large Scale Discrete Optimization, DIMACS Center, Rutgers University.

6/98 International School-Workshop on Computational Biology, International Center for Mechanical Sciences (CISM), Udine, Italy.

Plenary Talks/Tutorials at Conferences/Symposia

02/12 Tutorial on "Iterative Methods in Combinatorial Optimization", **Symposium on Theoretical Aspects of Computer Science (STACS)** 2012, Paris, France.

06/11 Workshop on "Design and Analysis of Randomized and Approximation Algorithms," **Schloss Dagstuhl**, Germany.

02/11 First NII-Shonan Meeting on "Graph Algorithms and Combinatorial Optimization," **Shonan Village Center**, Japan.

01/11 Invited lecturer, **2011 MSR-IMPECS School on Approximability** January 2011, IISc, Bengaluru, India.

01/10 Invited speaker on "Iterative Methods in Combinatorial Optimization", **Third Annual Microsoft Research Theory Day** 2010, IIT-Madras, Chennai, India.

12/09 Invited speaker on "Iterative Methods in Combinatorial Optimization", **IARCS Annual Conference on Foundations of Software Technology & Theoretical Computer Science** 2009, IIT-Kanpur, India.

11/08 Invited Lecture Series on "Iterative Methods in Combinatorial Optimization", **RIMS, Kyoto Univeristy**, Japan.

07/06 Semi-Plenary lecture on "Approximation Algorithms for Stochastic Combinatorial Optimization", **International Symposium on Mathematical Programming** 2006, Rio de Janeiro, Brazil.

06/06 Primary Lecturer, "Graph Metric and Embeddings," **DYNAMO Training School** 2006, Lisbon, Portugal.

03/06 Plenary Lecture, "Matching Based Augmentations for Approximating Connectivity Problems," **Latin American Theoretical Informatics Symposium** (LATIN '06), Valdivia, Chile.

05/05 Workshop on "Design and Analysis of Randomized and Approximation Algorithms," **Schloss Dagstuhl**, Germany.

02/05 Plenary lecture on "Approximation Algorithms for Stochastic Combinatorial Optimization", **Workshop on New Horizons in Computing**, Kyoto, Japan.

08/04 Principle Lecturer on "Integrating Information from Sequence and Evolution: An Introduction to Computational Biology", **DIMACS Summer Reconnect Conference** for faculty teaching undergraduates.

06/04 Workshop on "Approximation Algorithms for NP-hard problems", MFO, **Oberwolfach**, Germany.

08/03 Tutorial, "Metrics and Approximation Algorithms," **Second Workshop on Discrete Metric Spaces and their Algorithmic Applications**, Princeton University

09/02 Plenary Talk, "Bicriteria Approximations via Lagrangean Relaxations," **33rd Annual Conference of the Operational Research Society of Italy**, L'Aquila, Italy

09/02 Plenary Talk, "Bicriteria Spanning Trees," **ALGO 2002**, Joint European Algorithms Meetings, Rome, Italy

03/02 Invited Tutorial, "Metrics and Approximation Algorithms," **Workshop on Discrete Metric Spaces and their Algorithmic Applications**, Haifa, Israel

01/02 Invited Tutorial, "Applications of Graph Theory to Molecular Biology," **AMS-MAA Joint Mathematics Meeting**, San Diego, CA

12/99 Tutorial on Approximation Algorithms, post-conference event, **Tenth Annual International Symposium on Algorithms and Computation (ISAAC '99)**, Chennai, India

12/98 Plenary Talk, "Computational Challenges in Molecular Biology," **First Latin American School on Parallelism and High-performance Computing**, Merida, Venezuela

7/98 Invited Tutorial on Computational Biology, **DIMACS Reconnect Conference** Rutgers University, NJ

7/97 Invited Tutorial on Computational Biology, **Joint DIMACS/University of Buenos Aires Workshop**, Argentina

6/96 Invited Tutorial on Multiple Sequence Alignments, **Bat Sheva de Rothschild Workshop on Computational Aspects of the Human Genome Project**, Nahsholim, Israel

3/96 Plenary Talk, "Approximation Algorithms in Computational Biology," **Second Annual Workshop on Computational Biology**, Sandia National Laboratories, Albuquerque, NM

7/94 Week-long Invited Tutorial on Computational Biology, **DIMACS Summer Leadership Program for high-school teachers**, Rutgers University, NJ

Educational Activities

Teaching

(All courses at Carnegie Mellon unless otherwise noted.)

Fall '10, '11	**Optimization and Decision Making.** (Required course for MBA students).
Spring '10, Fall '10, '11	**Business Networks.** (New MBA elective).
Spring '10	**Social, Economic and Information Networks.** (New doctoral course).
Spring '09, Spring '10	**Network Science.** (New undergraduate course); **Social, Economic and Information Networks.** (Revised version).
Fall '07	**Iterative Relaxation and Rounding.** (New graduate course, co-taught with Mohit Singh).
Spring '07, '08, '10, '12	**Optimization for Interactive Marketing.** (New MBA elective co-taught with Prof. Baohong Sun).
Fall '06	**Mining Data for Decision Making.** (MBA elective)
Fall '05 - Spring '06	**Approximation Algorithms** (Year-long graduate course co-taught with Prof. Anupam Gupta). Lecture notes available on the web.
Fall 2003	**Metric Embeddings** (New graduate course, co-taught with Prof. Anupam Gupta). Lecture notes available on the web.
2003 onwards	**Probability and Decision Making** (New required course for MBA students).
Spring 2003	**Planarity** (New graduate course).
Spring 2001	**Computational Biology** (New graduate course).
1999 - 2003	**Decision Models.** (Revamped required course for MBA students).
Spring 1999	**Advanced Integer Programming**.
Spring 1997	**Network Design Algorithms** (New graduate course).
Fall 1996, '97, '98	**Introduction to Operations Research.** (Required course for MBA students).
Spring 1996	**Analysis of Heuristics** (New graduate course).
Spring 1996	**Modeling for Management Science Applications.** (MBA elective).
Fall 1995, '97, '08, '10	**Graph Theory.**
Fall 1995, '10	**Networks and Matchings.**
Fall 1995	**Convex Analysis.**
Spring 1995	**Advanced topics in Computer Science: Computational Biology.** (Co-instructor with Prof. Andrew Yao); Department of Computer Science, Princeton University.

Doctoral Student Advising (at Carnegie Mellon)

Giuseppe Lancia (Co-Chair, Thesis Committee)
(ACO/Operations Research, GSIA, CMU, 1997)
Thesis Title: Optimization Problems in Computational Molecular Biology
(Currently Associate Professor of Operations Research, University of Udine, Italy)

Fatma Sibel Salman (Chair, Thesis Committee)
(Operations Research, GSIA, CMU, 2000)
Thesis Title: Selected Problems in Network Design: Exact and Approximate Solution Methods
(Currently Assistant Professor, College of Engineering, Koç University, Istanbul, Turkey)

Goran Konjevod (Chair, Thesis Committee)
(ACO/Math Department, CMU, 2000)
Thesis Title: Generalizing Set Cover: Approximation Algorithms for Group Steiner Trees and Related Problems
(Currently Research Staff Member at Lawrence Livermore National Laboratories)

Bjarni Halldórsson (Chair, Thesis Committee)
(ACO/Math Department, CMU, 2001)
Thesis Title: Algorithms for Biological Sequence Problems
(Currently Associate Professor of Biomedical Engineering, Reykjavik University, Iceland)

Ojas Parekh (Chair, Thesis Committee)
(ACO/Math Department, CMU, 2002)
Thesis Title: Polyhedral Techniques for Approximation Algorithms
(Currently Research Staff Member at Sandia National Laboratories)

Jochen Könemann (Chair, Thesis Committee)
ACO/Operations Research, GSIA, CMU, 2003
Thesis Title: Approximation Algorithms for Minimum-Cost Low-Degree Subgraphs.
(Currently Associate Professor of Combinatorics and Optimization at University of Waterloo)

Amitabh Sinha (Chair, Thesis Committee)
(ACO/Operations Research, Tepper School of Business, CMU, 2004)
Thesis Title: Location, location, location and location: Facility location incorporating demand uncertainty, logistic network design, product heterogeneity and competition.
(Currently Assistant Professor of Operations and Management Science, Stephen M. Ross School of Business, University of Michigan, Ann Arbor)

Kedar Dhamdhere (Chair, Thesis Committee)
(Computer Science, SCS, CMU, 2005)
Thesis Title: Approximation Algorithms for Metric Embedding Problems.
(Currently Research Scientist at Google Labs)

Mohit Singh (Chair, Thesis Committee)
ACO/Operations Research, Tepper School of Business, CMU, 2008
Thesis Title: Iterative Methods in Combinatorial Optimization.
Winner of the Tucker Prize at the 2009 International Symposium on Mathematical Programming.
(Currently at Microsoft Research, Redmond)

Vineet Goyal (Chair, Thesis Committee)
ACO/Operations Research, Tepper School of Business, CMU, 2008
Thesis Title: Combinatorial Optimization Under Uncertainty.
(Currently Assistant Professor of Industrial Engineering and Operations Research at Columbia University)

Viswanath Nagarajan (Chair, Thesis Committee)
ACO/Operations Research, Tepper School of Business, CMU, 2009
Thesis Title: Approximation Algorithms for Sequencing Problems.
(Currently Permanent Research Staff Member at IBM Watson Research Center)

David Abraham (Chair, Thesis Committee)
Computer Science, SCS, CMU, 2009
Thesis Title: Matching Markets: Design and Analysis.
(Currently at Google)

Seyed Amin Sayedi Roshkar (Co-Chair, Thesis Committee)
ACO/Operations Research, Tepper School of Business, CMU, 2012
Thesis Title: Essays on Sponsored Search Advertising.
Initial Placement: UNC Kenan-Flagler

Afshin Nikzad (Chair, Thesis Committee)
(ACO/Operations Research, Tepper School of Business, CMU, Ongoing)

Doctoral Student Supervision (at Carnegie Mellon)

Hui Chen (1996) (Member, Thesis Committee, ACO/Math,CMU)
George Christopher (1997) (Member, Thesis Committee, ACO/Math, CMU)
Pinar Keskinocak (1997) (Member, Thesis Committee, ACO/Operations Research, CMU)
Neil Simonetti (1998) (Member, Thesis Committee, ACO/Math, CMU)
Andrea Richa (1998) (Member, Thesis Committee, ACO/Computer Science, CMU)
Claudson Bornstein (1998) (Member, Thesis Committee, Computer Science, CMU)
Lei Zhao (1999) (Member, Thesis Committee, ACO/Math, CMU)
Erlendur Thorsteinsson (2001) (Member, Thesis Committee, Operations Research, CMU)
Hak-Jin Kim (2002) (Member, Thesis Committee, Operations Research, CMU)
Nikhil Bansal (2003) (Member, Thesis Committee, Computer Science, CMU)
Giacomo Zambelli (2004) (Member, Thesis Committee, Operations Research, CMU)
Xinming Liu (2004) (Member, Thesis Committee, Operations Research, CMU)

Kerry Ojaikan (2004) (Member, Thesis Committee, Math, CMU)
Shuchi Chawla (2005) (Member, Thesis Committee, Computer Science, CMU)
Abraham Flaxman (2006) (Member, Thesis Committee, ACO/Math, CMU)
David Kravitz (2006) (Member, Thesis Committee, ACO/Math, CMU)
Juan Carlos Vera (2006) (Member, Thesis Committee, ACO/Math, CMU)
Kelley Burgin (2006) (Member, Thesis Committee, ACO/Math, CMU)
Teresa Maria Souza (2006) (Member, Thesis Committee, ACO/Operations Research, CMU)
Venkatesh Natarajan (2006) (Member, Thesis Committee, ACO/Math, CMU)
Hubert Chan (2007) (Member, Thesis Committee, ACO/Computer Science, CMU)
Srinath Sridhar (2007) (Member, Thesis Committee, Computer Science, CMU)
Barbara Anthony (2008) (Member, Thesis Committee, ACO/Math, CMU)
Chen Xiang (2008) (Outside Reader) (Production and Operations Management, CMU)
Daniel Golovin (2008) (Member, Thesis Committee, Computer Science, CMU)
Prasad Chebolu (2008) (Member, Thesis Committee, ACO/Math, CMU)
Latife Genc (2008) (Member, Thesis Committee, ACO/Operations Research, CMU)
Katrina Liggett (2009) (Member, Thesis Committee, Computer Science, CMU)
Ravishankar Krishnaswamy (2012) (Member, Thesis Committee, Computer Science, CMU)
Marco Molinaro (ongoing) (Member, Thesis Committee, ACO/Operations Research, CMU)
David Bergman (ongoing) (Member, Thesis Committee, ACO/Operations Research, CMU)

Supervision (outside Carnegie Mellon)

Jennifer Perone (1995), Undergraduate Thesis Advisor, Princeton University.
Dr. Guido Scheafer (2008), Member of Habilitation Committee, TU-Berlin.