

# Deeparnab Chakrabarty

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## Education

**Ph.D., Georgia Tech.** August 2008.

- *Field:* ACO (Algorithms, Combinatorics and Optimization).  
Interdisciplinary program in Computer Science, Mathematics, and  
Industrial Systems and Engineering Departments.

**B.Tech, IIT Bombay.** July 2003.

*Field:* Computer Science and Engineering.

## Employment History

Researcher, Microsoft Research, India, Oct 2011 – present

Post-doctoral Researcher, University of Pennsylvania, Feb 2010 – Jul 2011

Post-doctoral Fellow, University of Waterloo, Sep 2008 – Feb 2010.

## Research Statement.

I am interested in designing and understanding *efficient* algorithms using the lens of *optimization*. This spans the range of discovering new algorithms to analyzing existing algorithms for important problems arising in multifarious scenarios such as scheduling ([C28,C10]), auctions ([C9,C7]), property testing ([C27,C21,C20]), and to machine learning ([C26]).

## Selected Invited Workshops

- Workshop on Submodular Functions, Hausdorff Research Institute, Bonn, October 2015.
- Symposium on Learning, Algorithms, and Complexity, IISc, Bangalore, January 2015.
- Bertinoro Workshop on Sublinear Algorithms, Bertinoro, May 2014.
- International Symposium on Mathematical Programming, Chicago, August 2012.
- Flexible Network Design Workshop. Warsaw, July 2012.

## Professional Service

- PC Member: FSTTCS 2014, APPROX 2014, ITCS 2014, EC 2013, SODA 2013,
- Guest Editor: Theory of Computing special issue for APPROX 2014.
- Reviewer: (numerous) FOCS, STOC, SODA, ICALP, EC, SIAM Journal of Computing, SIAM Journal of Discrete Math, Theory of Computing, Discrete Mathematics, Algorithmica.

## Teaching Experience

- *Approximation Algorithms*, E0 249, Indian Institute of Science, Spring 2015. Designed and co-taught Masters level special topics course. 15 students.
- *Techniques in Approximation Algorithms*, CIS 800, University of Pennsylvania, Fall 2010. Designed and taught PhD level special topics course. 14 students.
- *Scheduling Theory*, CO 454, University of Waterloo, Spring 2009. Taught senior level undergraduate course. 22 students.

## Publications

### **Journal Papers**

J16. D. Chakrabarty, C. Swamy. *Facility Location with Client Latencies: Linear Programming Based Techniques for Minimum Latency Problems*. Mathematics of Operations Research, in press, (2015).

J15. D. Chakrabarty, S. Kannan, K. Tian. *Detecting Character Dependencies in Stochastic Models of Evolution*. Journal of Computational Biology, in press, (2015).

J14. D. Chakrabarty, Z. Huang. *Recognizing Coverage Functions*. SIAM Journal of Discrete Math, in press, (2015).

J13. D. Chakrabarty, C. Seshadhri. *A  $o(n)$  Monotonicity Tester for Boolean Functions over the Hypercube*. SIAM Journal of Computing, in press, (2015).

J12. D. Chakrabarty, C. Chekuri, S. Khanna, N. Korula. *Approximability of Capacitated Network Design*. Algorithmica, 72(2): 493 – 514, (2015).

J11. D. Chakrabarty, G. Goel, V. V. Vazirani, L. Wang, C. Yu. *Submodularity Helps in Nash and Non-symmetric Bargaining Games*. SIAM Journal of Discrete Math, 28(1), 99–115, (2014).

J10. D. Chakrabarty, J. Könemann, and D. Pritchard. *Hypergraphic LP Relaxations for Steiner Trees*. SIAM Journal of Discrete Math, 27(1), 507–533, (2013).

J9. E. Anshelevich, D. Chakrabarty, A. Hate, C. Swamy. *Approximations for the FireFighter Problem: Computing Cuts over Time*. Algorithmica, 62(1-2), 520–536, (2012).

J8. D. Pritchard and D. Chakrabarty. *Approximability of Sparse Integer Programs*. Algorithmica, 61(1), 75–93, (2011).

J7. D. Chakrabarty, N. R. Devanur, V. V. Vazirani. *New Geometry-Inspired Relaxations and Algorithms for the Metric Steiner Tree Problem*. Math. Programming, 130(1), 1–32, (2011).

J6. D. Chakrabarty, J. Könemann, and D. Pritchard. *Integrality Gap of the Hypergraphic Relaxation of Steiner Trees: a short proof of a 1.55 upper bound*. Operations Research Letters, 38(6), 567–570, (2010).

J5. D. Chakrabarty, N. R. Devanur, V. V. Vazirani. *Rationality and Strongly Polynomial Solvability of Eisenberg-Gale Markets with Two Agents*. SIAM Journal of Discrete Math, 24(3), 1117–1136, (2010).

J4. D. Chakrabarty, A. Mehta, V. V. Vazirani. *Design is as easy as Optimization*. SIAM Journal of Discrete Math, 24(1), 270–286, (2010).

J3. D. Chakrabarty, G. Goel. *On the Approximability of Budgeted Allocations and Improved Lower Bounds for Submodular Welfare Maximization and GAP*. SIAM Journal of Computing, 39(6), 2010.

J2. B. Benson, D. Chakrabarty, P. Tetali. *G-parking functions, Acyclic Orientations, and Spanning Trees*. Discrete Math, 310(8), 1340–1353, (2010).

J1. D. Chakrabarty, N. Devanur. *On Competitiveness in Uniform Utility Allocation Markets*. Operations Research Letters, 37(3), 155–158, (2009).

### **Conference Papers**

C29. D. Chakrabarty, A. Ene, R. Krishnaswamy, D. Panigrahi. *Online Buy-at-Bulk Network Design*. Proceedings of the 56th IEEE Conference on Foundations of Computer Science (FOCS), 2015.

C28. D. Chakrabarty, S. Khanna, S. Li. *On  $(1, \varepsilon)$ -restricted assignment makespan minimization*. Proceedings of the ACM-SIAM Symposium on Discrete Algorithms (SODA), 2015.

C27. D. Chakrabarty, K. Dixit, M. Jha, C. Seshadhri. *Property Testing on Product Distributions: Optimal Testers for Bounded Derivative Properties*. Proceedings of the ACM-SIAM Symposium on Discrete Algorithms (SODA), 2015. **Invited to Special Issue of ACM Transactions on Algorithms.**

C26. D. Chakrabarty, P. Jain, P. Kothari. *Provable Submodular Minimization using Wolfe's Algorithm*. Advances in Neural Information Processing Systems 27 (NIPS), 2014. **Selected for oral presentation.** (nearly  $\sim 1\%$  of submissions.)

C25. D. Chakrabarty, C. Swamy. *Welfare maximization and truthfulness in mechanism design with ordinal preferences*. Proceedings of the 5th Innovations in Theoretical Computer Science conference (ITCS), 2014.

C24. D. Chakrabarty, R. Krishnaswamy, S. Li, S. Narayanan. *Capacitated Network Design on Undirected Graphs*. Proceedings of the 16th International Workshop on Approximation Algorithms for Combinatorial Optimization Problems.(APPROX), 2013.

C23. D. Chakrabarty, C. Seshadhri. *An Optimal Lower Bound for Monotonicity Testing over Hypergrids*. Proceedings of the 16th International Workshop on Randomization and Computation (RANDOM), 2013.

C22. D. Chakrabarty, D. Charles, M. Chickering, N. Devanur, L. Wang. *Budget Smoothing for Internet Ad Auctions: A Game Theoretic Approach*. Proceedings of 14th ACM Conference on Electronic Commerce (EC), 2013.

C21. D. Chakrabarty, C. Seshadhri. *A  $o(n)$  monotonicity tester for Boolean functions over the hypercube*. Proceedings of the 45th Annual ACM Symposium on Theory of Computing (STOC), 2013. **Invited to Special Issue of SIAM Journal of Computing**.

C20. D. Chakrabarty, C. Seshadhri. *Optimal bounds for monotonicity and Lipschitz testing over hypercubes and hypergrids*. Proceedings of the 45th Annual ACM Symposium on Theory of Computing (STOC), 2013.

C19. D. Chakrabarty, Z. Huang. *Testing Coverage Functions*. Proceedings of the 39th International Colloquium on Automata, Languages and Programming (ICALP), 2012.

C18. A. Bhalgat, D. Chakrabarty, S. Khanna. *Social Welfare in One-Sided Matching Markets without Money*. Proceedings of the 14th International Workshop on Approximation Algorithms for Combinatorial Optimization Problems (APPROX), 2011

C17. A. Bhalgat, D. Chakrabarty, S. Khanna. *Optimal Lower Bounds for Universal and Differentially Private Steiner Trees and TSP*. Proceedings of the 14th International Workshop on Approximation Algorithms for Combinatorial Optimization Problems (APPROX), 2011

C16. D. Chakrabarty, C. Chekuri, S. Khanna, and N. Korula. *Approximability of Capacitated Network Design*. Proceedings of the XV conference on Integer Programming and Combinatorial Optimization (IPCO), 2011. Conference version of [J12].

C15. D. Chakrabarty, C. Swamy. *Facility Location with Client Latencies: Linear Programming Based Techniques for Minimum Latency Problems*. Proceedings of the XV conference on Integer Programming and Combinatorial Optimization (IPCO), 2011.

C14. D. Chakrabarty, E. Grant, J. Könemann. *On Column-restricted and Priority Covering Integer Programs*. Proceedings of the XIV conference on Integer Programming and Combinatorial Optimization (IPCO), 2010.

C13. D. Chakrabarty, J. Könemann, D. Pritchard. *Hypergraphic Relaxations for Steiner Trees*. Proceedings of the XIV conference on Integer Programming and Combinatorial Optimization (IPCO), 2010. Conference version of [J10].

C12. M. Ammar, D. Chakrabarty, A. Das Sarma, S. Kalyanasundaram, R. J. Lipton. *Algorithms for Message Ferrying on Mobile ad hoc Networks*. Proceedings of the IARCS Annual Conference on Foundations of Software Technology and Theoretical Computer Science (FSTTCS), 2009.

C11. E. Anshelevich, D. Chakrabarty, A. Hate, C. Swamy. *Approximations for the FireFighter Problem: Cuts over Time and Submodularity*. Proceedings of the 20th International Symposium on Algorithms and Computation (ISAAC), 2009. Conference version of [J9].

C10. D. Chakrabarty, J. Chuzhoy, S. Khanna. *On Allocating Goods to Maximize Fairness*. Proceedings of the 50th IEEE Conference on Foundations of Computer Science (FOCS), 2009.

C9. D. Chakrabarty, Y. Zhou, R. Lukose. *Budget Constrained Bidding in Keyword Auctions and Online Knapsack Problems*. Proceedings of the 4th Workshop on Internet and Network Economics (WINE), 2008.

C8. D. Chakrabarty, G. Goel, V. V. Vazirani, L. Wang, C. Yu. *Efficiency, Fairness and Competitive-ness in Nash Bargaining Games*. Proceedings of the 4th Workshop on Internet and Network Economics (WINE), 2008. Conference version of [J11].

C7. D. Chakrabarty, G. Goel. *On the Approximability of Budgeted Allocations and Improved Lower Bounds for Submodular Welfare Maximization and GAP*. Proceedings of the 49th IEEE Conference on Foundations of Computer Science (FOCS), 2008. Conference version of [J3].

C6. D. Chakrabarty, N. R. Devanur, V. V. Vazirani. *New Geometry-Inspired Relaxations and Algorithms for the Metric Steiner Tree Problem*. Proceedings of the XIII conference on Integer Programming and Combinatorial Optimization (IPCO), 2008. Conference version of [J2].

C5. D. Chakrabarty, N. R. Devanur. *On Competitiveness in Uniform Utility Allocation Markets*. Proceedings of 3rd Workshop on Internet and Network Economics (WINE) 2007. Conference version of [J1].

C4. A. Das Sarma, D. Chakrabarty, S. Gollapudi. *Public Advertisement Broker Markets*. Proceedings of 3rd Workshop on Internet and Network Economics (WINE) 2007.

C3. D. Chakrabarty, N. R. Devanur, V. V. Vazirani. *New Results on Rationality and Strongly Polynomial Time Solvability in Eisenberg-Gale Markets*. Proceedings of 2nd Workshop on Internet and Network Economics (WINE), 2006. Conference version of [J6].

C2. D. Chakrabarty, A. Mehta, V. V. Vazirani. *Design is as easy as Optimization*. Proceedings of the 33rd International Colloquium on Automata, Languages and Programming (ICALP), 2006. Conference version of [J5].

C1. D. Chakrabarty, A. Mehta, V. Nagarajan, V. V. Vazirani. *Fairness and Optimality in Congestion Games*. Proceedings of 6th ACM Conference on Electronic Commerce (EC), 2005.

### Reference Works

R1. D. Chakrabarty. *Max-Min Allocation*. Encyclopedia of Algorithms, 2015.

R2. D. Chakrabarty. *Monotonicity Testing*. Encyclopedia of Algorithms, 2015.

22<sup>nd</sup> October, 2015.