

RUTA MEHTA

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RESEARCH INTERESTS

Algorithmic Game Theory, Analysis of Strategic Behavior, Combinatorial Optimization, Genetic Evolution, Dynamical Systems, Machine Learning.

EDUCATION

Postdoctoral Fellow	Simons Institute for the Theory of Computing, UC Berkeley.	Jul - Dec, 2015
Postdoctoral Fellow	College of Computing, Georgia Institute of Technology. Mentor: Vijay V. Vazirani	2012 - 2015
Ph.D.	Comp. Sci. and Eng., Indian Institute of Technology, Bombay. Advisors: Milind Sohoni and Bharat Adsul	2007 - 2012
M.Tech.	Comp. Sci. and Eng., Indian Institute of Technology, Bombay.	2003 - 2005
B.E.	Comp. Sci. and Eng., Maharaja Saiyajirao University, Baroda.	1999 - 2003

APPOINTMENTS

Assistant Professor	Dept. of Computer Science, Univ. of Illinois at Urbana-Champaign	Jan 2016 - present
Research Intern	IBM Research Lab, Delhi	Summer, 2008 & 2009
Software Eng. & Dev.	Sybase Software India Pvt. Ltd.	2005 - 2007

HONORS AND AWARDS (selected)

- NSF CAREER Award, 2018.
- Listed in the “*Instructors Rated as Excellent by Students @ U. of Illinois*” 2017.
- Outstanding Postdoctoral Researcher Award, College of Computing, Georgia Tech, 2014.
- ACM India Doctoral Dissertation Award, 2012.
- Excellence in Ph.D. Thesis Award, IIT-Bombay, 2012.
- Google India Anita Borg Memorial Scholarship, 2012.
- IBM PhD Award, 2010 (Awarded annually to one Indian PhD student).

SERVICES (selected)

- **Associate Editor:**
 - Mathematics of Operations Research (MOR) 2020 - present
 - ACM Transactions on Economics and Computation (TEAC) for the special issue of WINE 2020.
- **(Co)Chair:**
 - Area Chair EC 2021.
 - Program co-Chair WINE 2020.
 - Tutorail Chair WINE 2017.
- On the (senior) PC of EC’20 and STOC’21.

STUDENT RESEARCH ADVISING

- PhD students
 - Shant Boodaghians, 2016 - present (gave preliminary exam in Spring'21.)
 - Rucha Kulkarni, 2017 - present
 - Vasileios Livanos, 2017 - present
 - Aniket Murhekar, 2020 - present
- Masters students
 - Aniket Murhekar 2019 - 20 (**Siebel Scholar 2020**. Now a PhD student at UIUC)
 - Spencer Gordon, 2016 - 17 (**Siebel Scholar 2017**. Now a PhD student at CalTech)
- Undergraduate students
 - Shivam Gupta, 2017 - 18 (Franz Hohn and JP Nash scholarship 2015 - 16, Illinois engineering scholarship 2017-18. Now a PhD student at UT Austin.)

PUBLICATIONS (papers with students are marked with *)

Refereed Conference Papers

- *C39. Indivisible Mixed Manna: On the Computability of MMS + PO Allocations. Rucha Kulkarni, Ruta Mehta, Setareh Taki. Accepted to EC 2021.
- *C38. Improving EFX Guarantees through Rainbow Cycle Number. Bhaskar Ray Chaudhury, Jugal Garg, Kurt Mehlhorn, Ruta Mehta, Pranabendu Misra. Accepted to EC 2021.
- *C37. Competitive Allocation of a Mixed Manna. Bhaskar Ray Chaudhury, Jugal Garg, Peter McGlaughlin, and Ruta Mehta. Proceedings of the 32nd Annual ACM-SIAM Symposium on Discrete Algorithms (SODA), 2021.
- *C36. PTAS for Maximin Shares in an Indivisible Mixed Manna. Rucha Kulkarni, Ruta Mehta, and Setareh Taki. Proceedings of the 35th AAAI Conference on Artificial Intelligence (AAAI), 2021.
- *C35. Fair and Efficient Allocations under Subadditive Valuations. Bhaskar Ray Chaudhury, Jugal Garg, and Ruta Mehta. Proceedings of the 35th AAAI Conference on Artificial Intelligence (AAAI), 2021.
- *C34. Online Revenue Maximization for Server Pricing. Shant Boodaghians, Federico Fusco, Stefano Leonardi, Ruta Mehta, and Yishay Mansour. In *IJCAI-PRICAI*, 2020.
- *C33. Approximate Nash Equilibria of Imitation Games: Algorithms and Complexity. Aniket Murhekar and Ruta Mehta. In *International Conference on Autonomous Agents and Multi-Agent Systems (AAMAS)*, 2020.
- *C32. Smoothed Efficient Algorithms and Reductions for Network Coordination Games. Shant Boodaghians, Rucha Kulkarni, and Ruta Mehta. In *Innovations in Theoretical Computer Science (ITCS)*, 2020.
- *C31. Multiclass Performance Metric Elicitation. Gaurush Hiranandani, Shant Boodaghians, Ruta Mehta, and Oluwasanmi Koyejo. To appear in *23rd conference on Neural Information Processing Systems (NeuroIPS)*, 2019.
- *C30. Unique End of Potential Line. John Fearnley, Spencer Gordon, Ruta Mehta, and Rahul Savani. In *46th International Colloquium on Automata, Languages and Programming (ICALP)*, 56:1–56:15, 2019.
- *C29. Eliciting Binary Performance Metrics. Gaurush Hiranandani, Shant Boodaghians, Ruta Mehta, and Oluwasanmi Koyejo. In *22nd International Conference on Artificial Intelligence and Statistics (AISTATS)*, 371–379, 2019.

- C28. Universal Growth in Production Economies. Simina Branzei, Ruta Mehta, and Noam Nisan. In *32nd Conference on Neural Information Processing Systems (NIPS)*, 1973–1973, 2018.
- C27. Social Welfare and Profit Maximization from Revealed Preferences. Ziwei Ji, Ruta Mehta, and Matus Telgarsky. In *the 14th Conference on Web and Internet Economics (WINE)*, 264–281, 2018.
- *C26. Nash Equilibrium Computation in Resource Allocation Games. Shivam Gupta and Ruta Mehta. In *17th International Conference on Autonomous Agents and Multiagent Systems (AAMAS)*, 1953–1955, 2018.
- C25. Sum-of-Squares Meets Nash: Lower Bounds for Finding Any Equilibrium. Pravesh Kothari and Ruta Mehta. In *50th Annual Symposium on the Theory of Computation (STOC)*, 1241–1248, 2018.
- C24. Maximizing Profit with Convex Costs in the Random-order Model. Anupam Gupta, Ruta Mehta, and Marco Molinaro. In *45th International Colloquium on Automata, Languages, and Programming (ICALP)*, 2018.
- C23. A New Class of Combinatorial Markets with Covering Constraints: Algorithms and Applications. Nikhil Devanur, Jugal Garg, Ruta Mehta, Vijay V. Vazirani, and Sadra Yazdanbod. In *29th Annual ACM-SIAM Symposium on Discrete Algorithms (SODA)*, 2311–2325, 2018.
- C22. Settling the Complexity of Leontief and PLC Exchange Markets under Exact and Approximate Equilibria. Jugal Garg, Ruta Mehta, Vijay V. Vazirani and Sadra Yazdanbod. In *49th Annual ACM SIGACT Symposium on Theory of Computing (STOC)*, 890–901, 2017.
- C21. Mutation, Sexual Reproduction and Survival in Dynamic Environments. Ruta Mehta, Ioannis Panageas, Georgios Piliouras, Prasad Tetali, and Vijay V. Vazirani. In *8th Innovations in Theoretical Computer Science Conference (ITCS)*, 2017.
- C20. Nash Social Welfare Approximation for Strategic Agents. Simina Branzei, Ruta Mehta, and Vasilis Gkatzelis. In *2017 ACM Conference on Economics and Computation (EC)*, 611–628, 2017.
- C19. An Incentive Compatible, Efficient Market for Air Traffic Flow Management. Ruta Mehta and Vijay V. Vazirani. In *23rd International Computing and Combinatorics Conference (COCOON)*, 407–419. Springer, 2017. (*Invited to a special issue of Theoretical Computer Science*).
- C18. Multilinear Games. Hau Chu, Albert Jiang, Kevin Leyton-Brown, and Ruta Mehta. In *12th International Conference on Web and Internet Economics (WINE)*, 44–58. Springer Berlin Heidelberg, 2016.
- C17. The Complexity of Genetic Diversity: Sex with Two Chromosomes is Advantageous but Unpredictable. Ruta Mehta, Ioannis Panageas, Georgios Piliouras and Sadra Yazdanbod. In *24th Annual European Symposium on Algorithms (ESA)*, 65:1–65:17, 2016.
- C16. Get Me to My GATE On Time: Efficiently Solving General-Sum Bayesian Threat Screening Games. Aaron Schlenker, Matthew Brown, Arunesh Sinha, Milind Tambe, and Ruta Mehta. In *22nd European Conference on Artificial Intelligence (ECAI)*, 1476–1484, 2016.
- C15. To Give or not to Give: Fair Division with Strict Preferences. Simina Branzei, Yuezhou Lv, and Ruta Mehta. In *25th International Joint Conference on Artificial Intelligence (IJCAI)*, 123–129, 2016.
- C14. ETR-Completeness of Decision Versions of 3-Nash. Jugal Garg, Ruta Mehta, Vijay V. Vazirani and Sadra Yazdanbod. In *42nd International Colloquium on Automata, Languages, and Programming (ICALP)*, 554–566, 2015.
- C13. Natural Selection as an Inhibitor of Genetic Diversity: Multiplicative Weights Update Algorithm and a Conjecture of Haploid Genetics. Ruta Mehta, Ioannis Panageas, and Georgios Piliouras. In *2015 Conference on Innovations in Theoretical Computer Science (ITCS)*, 73–73, 2015.

- C12. Settling Some Open Problems on Symmetric Nash Equilibria. Ruta Mehta, Vijay V. Vazirani, and Sadra Yazdanbod. In *8th International Symposium on Algorithmic Game Theory (SAGT)*, 272–284, 2015.
- C11. Constant Rank Bimatrix Games are PPAD-hard. Ruta Mehta. In *46th Annual ACM Symposium on Theory of Computing (STOC)*, 545–554, 2014. (Invited to a special issue of *SIAM Journal on Computing*).
- C10. Dichotomies in equilibrium computation, and complementary pivot algorithms for a new class of non-separable utility functions. Jugal Garg, Ruta Mehta, and Vijay V. Vazirani. In *46th Annual ACM Symposium on Theory of Computing (STOC)*, 525–534, 2014.
- C9. Learning Economic Parameters from Revealed Preferences. Maria-Florina Balcan, Amit Daniely, Ruta Mehta, Ruth Urner, and Vijay V. Vazirani. In *10th International Conference on Web and Internet Economics (WINE)*, 338–353, 2014.
- C8. To Save Or Not To Save: The Fisher Game. Ruta Mehta, Nithum Thain, Laszlo A. Vegh, and Adrian Vetta. In *10th International Conference on Web and Internet Economics (WINE)*, 294–307, 2014.
- C7. Exchange Markets: Strategy meets Supply-Awareness. Ruta Mehta, and Milind Sohoni. In *9th International Conference on Web and Internet Economics (WINE)*, 361–362, 2013.
- C6. A Complementary Pivot Algorithm for Market Equilibrium under Separable, Piecewise-Linear Concave Utilities. Jugal Garg, Ruta Mehta, Milind Sohoni and Vijay V. Vazirani. In *44th annual ACM symposium on Theory of computing (STOC)*, 525–534, 2012.
- C5. The Weighted Majority Algorithm does not Converge in Nearly Zero-sum Games. Maria Florina Balcan, Florin Constantin, and Ruta Mehta. In *ICML 2012 workshop on Markets Mechanisms and Multi-Agent Models*, 2012.
- C4. Rank-1 Bimatrix Games: A Homeomorphism and a Polynomial Time Algorithm. Bharat Adsul, Jugal Garg, Ruta Mehta, and Milind Sohoni. In *43rd annual ACM symposium on Theory of computing (STOC)*, 195–204, 2011.
- C3. Bilinear Games: Polynomial Time Algorithms for Rank Based Subclasses. Jugal Garg, Albert X. Jiang, and Ruta Mehta. *International Workshop on Internet and Network Economics (WINE)*, 399–407, 2011.
- C2. Nash Equilibria in Fisher Market. with Bharat Adsul, Ch. Sobhan Babu, Ruta Mehta, Jugal Garg, and Milind Sohoni. In *3rd International Symposium on Algorithmic Game Theory (SAGT)*, 30–41, 2010.
- C1. A Simplex-like Algorithm for Fisher Markets. Bharat Adsul, Ch. Sobhan Babu, Jugal Garg, Ruta Mehta, and Milind Sohoni In *3rd International Symposium on Algorithmic Game Theory (SAGT)*, 18–29, 2010.

Refereed Journal Papers

- J10. Nash Social Welfare Approximation for Strategic Agents. Simina Branzei, Vasilis Gkatzelis, and Ruta Mehta. *Operations Research*. *Forthcoming*.
- J9. Fast Algorithms for Rank-1 Bimatrix Games. Bharat Adsul, Jugal Garg, Ruta Mehta, Milind Sohoni, and Bernhard von Stengel. *Operations Research*. *Forthcoming*.
- J8. Unique end of potential line. John Fearnley, Spencer Gordon, Ruta Mehta, Rahul Savani. *Journal of Computation and System Sciences (JCSS)*, 114:1-35, 2020.
- J7. Constant Rank Bimatrix Games are PPAD-hard. Ruta Mehta. *SIAM Journal on Computing*, 47(5), 18581887. *Special Section on the 46th Annual ACM Symposium on Theory of Computing (STOC 2014)*. (invited)

- J6. Substitution with Satiation: A New Class of Utility Functions and a Complementary Pivot Algorithm. Jugal Garg, Ruta Mehta, and Vijay Vazirani. *Mathematics of Operations Research*, 43(3): 996-1024, 2018.
- J5. Jugal Garg, Ruta Mehta, Vijay Vazirani, and Sadra Yazdanbod. ETR-Completeness for Decision Versions of Multi-Player (Symmetric) Nash Equilibria. *ACM Transactions on Economics and Computation*, 6(1): 1:1-1:23, 2018.
- J4. An Incentive Compatible, Efficient Market for Air Traffic Flow Management. Ruta Mehta and Vijay V. Vazirani. *Theoretical Computer Science*, 2018.
- J3. Dichotomies in Equilibrium Computation, and Membership of PLC markets in FIXP. Jugal Garg, Ruta Mehta, and Vijay Vazirani. *Theory of Computing*, 12(1): 1-25, 2016.
- J2. A Complementary Pivot Algorithm for Market Equilibrium under Separable, Piecewise-Linear Concave Utilities. Jugal Garg, Ruta Mehta, Milind Sohoni, and Vijay Vazirani. *SIAM Journal on Computing* 44(6): 1820-1847, 2015.
- J1. A Simplex-like Algorithm for Fisher Markets. Bharat Adsul, Ch. Sobhan Babu, Jugal Garg, Ruta Mehta and Milind Sohoni. *Current Science*, 103(9): 1033-1042, 2012.

Manuscripts and Submitted Papers

- *P1. On the Complexity of Competitive Equilibrium with Chores (Bads are Harder than Goods). With Bhaskar Ray Chaudhary, Jugal Garg, and Peter McGlaughlin, 2021.

TEACHING

- CS 374: Introduction to Algorithms & Models of Computation, Spring'20
- CS 473: Theory II, Spring'21, Spring'18, Fall'16 (co-taught).
- CS 598: Topics on Algorithmic Game Theory, Fall'20, Fall'19, Fall'18, Spring'17, Spring'16. (Listed in the *Instructors rated as Excellent by students*, 2017).
- CS 8803: Advanced Topics in Algorithmic Game Theory, Spring 2013 (co-taught at Georgia Tech).

INVITED AND CONFERENCE TALKS

- **Computability of Equilibria in Two-Player Games**
 - *Keynote* at 13th Symposium on Algorithmic Game Theory (SAGT) 2020, Augsburg, Germany.
 - Complexity of Algorithmic Game Theory, workshop@FSTTCS, Mumbai. - Dec'19
 - *Colloquium* at Toyota Technological Institute at Chicago. - Oct'19
- **Sum-of-Squares Meets Nash: Lower Bounds for Finding Any Equilibrium**
 - Algorithms and Randomness Workshop, Georgia Tech, Atlanta. - May'18
- **Combinatorial Markets with Covering Constraints: Algorithms and Applications**
 - COST Workshop on Algorithmic Game Theory, Rome, Italy. - Mar'18
 - Algorithms and Optimization Workshop, ICTS Bangalore. - Jan'18
- **Social Welfare and Profit Maximization from Revealed Preferences**
 - Algorithms and Uncertainty Reunion Workshop, Simons Institute, UC Berkeley. - Dec'18
- **Nash Social Welfare Approximation for Strategic Agents**

- RAIN Seminar, Stanford. - Oct'20
- Economics and Computation Reunion, Simons Institute, UC Berkeley. - Apr'17
- 67th Midwest Theory Day, Indiana University Bloomington. - Mar'17
- **A Market for Scheduling, and a Polynomial time Algorithm for Computing Equilibria**
 - Bellairs Workshop on Algorithmic Game Theory, Barbados. - Apr'16
 - Econ-CS Seminar, Duke University. - Mar'16.
 - Game Theory Workshop at HIM, Universität Bonn. (*plenary talk*) - Dec'15.
- **Games, Equilibria, and Evolution**
 - Theory Seminar, Dept. of Computer Science, Duke University. - Mar'16.
- **Leontief Markets Can Solve Multivariate Polynomial Equations, Yielding FIXP and ETR Hardness**
 - Mathematics of Information seminar at CMI, CalTech. - Jan'15
 - TTIC Colloquium at Toyota Technological Institute (TTI), Chicago. - Oct'14.
 - ACO Student Seminar at Georgia Tech, Atlanta. - Nov'14.
- **(Essentially) Resolving the Complexity of Constant Rank Bimatrix**
 - Simons Institute for the Theory of Computing, UC Berkeley. - Nov'15
 - International Symposium on Math. Programming Pittsburgh. Jul'15
 - Theory Seminar at U. Chicago. - Oct'14.
 - Dagstuhl Seminar on Equilibrium Computation, Germany. - Aug'14
 - Bellairs Workshop on Algorithmic Game Theory, Barbados. (*plenary talk*) - Apr'14
 - Algorithms and Complexity Seminar at MIT. - Nov'13
 - ESRC workshop on Algorithmic Game Theory, LSE, London, UK. - Oct'13
- **Rank-1 Bimatrix Games: A Homeomorphism and a Polynomial Time Algorithm**
 - Workshop on Computational Game Theory, Stony Brook, NY. - July'13
 - Computer Science Division, University of California Berkeley. - Apr'13
 - ACO Colloquium, College of Computing, Georgia Tech, Atlanta. - Apr'13
 - China Theory Week 2012, Aarhus University, Denmark. - Aug'12
 - Mysore Park Theory Workshop 2012, Mysore, India. - Aug'12
 - Seminar, Dept. of CSE, IIT, Bombay. - Feb'11
 - Seminar, Dept. of IEOR, IIT, Bombay. - Feb'11
 - Indo-US Symposium, IISC, India. - Dec'10
- **On Computability of Equilibria in Markets with Production.**
 - International Symposium on Mathematical Programming, Berlin - Aug'12
- **A Complementary Pivot Algorithm for Market Equilibrium under Separable, Piecewise-Linear Concave Utilities**
 - ARC Colloquium, College of Computing, Georgia Tech, Atlanta. - Dec'11

PROFESSIONAL ACTIVITIES

- **Program Committee:** Senior committee member for a number of major theoretical CS and algorithmic game theory conferences including STOC, FOCS, SODA, EC, ICALP, ITCS, WINE, FSTTCS, SAGT, AAI, WWW.
- **(Co)Organized Workshops and Events:**
 - *Rising Stars in EECS*, 2019, held at U. of I. at Urbana-Champaign. Mentoring workshop for women PhD students interested in academia.
 - *AGT Mentoring Workshop*, 2018, co-located with the 19th ACM Conference on Economics and Computation, Cornell University, Ithaca, USA.
 - A session on *Career Advice for Graduate Students*, 2017, at the 18th ACM Conference on Economics and Computation, MIT.
 - *Game Theory Workshop*, Dec 14 - 17, 2015, as a part of Combinatorial Optimization trimester at Hausdorff Center for Mathematics, Universität Bonn, Germany.
- **Committee Memberships:** Includes undergraduate study committee, graduate study committee, outreach committee.
- **Member of Ph.D. Examining Committee:**
 1. PhD thesis of Sadra Yazdanbod, 2018 (Georgia Tech, Advisor: Vijay Vazirani)
 2. PhD thesis of Haiming Jin, 2017 (U. of I. at Urbana-Champaign, Advisor: Klara Nahrstedt)
 3. PhD thesis proposal of Vivek Madan, 2017 (U. of I. at Urbana-Champaign, Advisor: Chandra Chekuri)
 4. PhD thesis of Ioannis Panageas, 2016 (Georgia Tech, Advisor: Prasad Tetali)
 5. PhD thesis of Eric Chastain, 2016 (Rutgers U., Advisor: Eric Allender)
- Part of organizing committee of FSTTCS 2011.