Georgia Tech

Algorithms and Randomness Center: ANNUAL Report 2012

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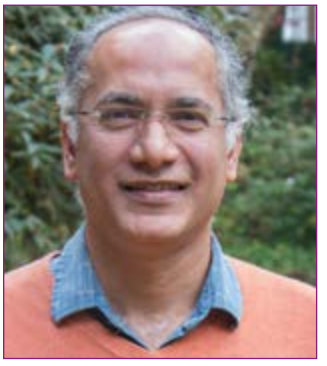


Director's Summary:

Building on the solid foundation laid by the founding director (Santosh Vempala), the current director, Pasad Tetali and Algorithms & Randomness Center (ARC) faculty have made strides in increasing the national and global visibility of ARC. The new initiatives include (i) organizing thematic focus year workshops and conferences on topics of frontier research, (ii) launching the inaugural (and annual) ARC Theory Day as well as the ARC-Center for Robotics and Intelligent Machines (RIM) Industry Day, (iii) hosting academic and industrial research visitors on a short-term basis, and (iv) contributing to the educational mission of Georgia Tech by incorporating tutorial-style lectures into each of the above research initiatives. Collaborations across campus and nation-wide culminated in a highly competitive (and pending) National Science Foundation (NSF) Expeditions proposal on Algorithmic Challenges of 21st Century involving nine faculty from five schools on campus, and an additional nine top researchers from other universities as well as Microsoft Research.

To broaden the scope and involvement, help plan thematic years and other activities, there is a newly appointed steering committee:

Steering Committee: Ton Dieker (School of Industrial Systems Engineering), Vladimir Koltchinskii (School of Mathematics), Dana Randall (School of Computer Science), Justin Romberg (School of Electrical and Computer Engineering), Santosh Vempala (School of Computer Science), Eric Vigoda (School of Computer Science).

Board and Committee Members: Distinguished Scientist and Managing Director Jennifer Chayes of Microsoft Research-New England as well as that of the newly created Microsoft Research-New York has been appointed as a new member on the ARC Advisory Board.

Student Fellowship Committee: This committee is in charge of evaluating the ARC student fellowship applications each Fall and Spring semester. In the past it has been chaired by P. Tetali (2008-11) and T. Dieker (ISyE, 2011-12) and has had a rotating ensemble of ARC faculty. Doctor S. Vempala is the current chair, with the other members being N. Balcan (SCS), G. Blekherman (SoM), S. Boldyreva (SCS), Santanu Dey (ISyE), and D. Goldberg (ISyE)

Research Activities

THE ThinkTank ASPECT

An important objective of ARC is to provide consulting and otherwise help on all matters algorithmic! To facilitate this, ARC hosts research lunches featuring guests from various branches of the Sciences and the Engineering on a regular basis. The guest lecturer gives a brief fifteen-minute presentation after which the discussion is typically interactive with the intent to model, analyze and help solve problems from a rigorous and algorithmic perspective. While the participation is by invitation, prospective guests are highly encouraged and welcomed to write to the ARC Director for a visit. See www.arc.gatech.edu/content/research as well as the recently compiled ARC Self-Assessment document for additional information.

Recent Examples:

- Guest: Eric Gilbert, School of Interative Computing (SIC), Georgia Tech
- Guest: Sean Webb, Enterpreneur, Adamas Inc. Charlotte, NC
- Guest: Anton Kleywegt, SIC, Georgia Tech
- Guest: Josh Weitz, School of Biology (SoB), Georgia Tech

Past guests include: Jeff Skolnick (SoB), Henrik Christensen (SIC), Steve McLaughlin (ECE), Justin Romberg (ECE), David Bader (School of Computational Science and Engineering), Mostafa Ammar (SCS) etc.

Research Collaborations ARC-RIM Collaboration

F. Dellaert (Interactive Computing faculty and RIM member) and P. Tetali have been collaborating, with the help of their graduate students, on subgraph preconditioners for simultaneous localization and mapping, a challenging problem inspired by autonomous mobile robots. Current progress is being reported in: "Support-theoretic subgraph preconditioners for large-scale Simultaneous Localization and Mapping (SLAM)."

UNDERGRADUATE INVOLVEMENT

School of Computer Science undergraduates and programming experts Kyle Davis, Zhongtian Zhang, and more recently Daniel Hull have been helping the directors of ARC and RIM in tackling challenging 3-D bin and vehicle routing problems, arising from robotics-based supply chain industry applications. Algorithms, Combinatorics, and Optimization (ACO) graduate students Pushkar Tripathi and Arindam Khan have helped mentor the undergraduates and trained them with the relevant algorithmic theory.

More recently the ARC postdocs Jugal Garg and Ruta Mehta have joined in the efforts to tackle these challenging theoretical and practical problems, inspired by the physical flow problems from the real world.

RESEARCH PROJECTS BY GRADUATE STUDENTS

Since Spring 2008, in all 47 students from various schools have received fifty percent research assistant funding by ARC, typically matched by the Ph.D. advisors. The continuing support of competitive research proposals from the graduate students resulted in the following winners during 2012-13.

FALL 2012

1. P. Bhakta (advisor: D. Randall): "Mixing times of the Schelling segregation model and biased permutations"
2. A. Khan (mentors: P. Tetali and H. Christensen): "Algorithms for 3-D geometric bin packing"
3. A. Louis (mentors: P. Tetali and S. Vempala): "A new approach towards graph coloring"
4. F. Shokrieh (advisor: M. Baker): "Random basis algorithm for regular matorids"

SPRING 2013

1. A. Guzman (advisor: A. Nemirovski): "A new model for image regularization"
2. C-H. Liu (advisor: R. Thomas): "Well-quasi-ordering graphs by the immersion relation"
3. D. Moran (advisor: S. Dey): "On cutting planes for convex mixed-integer programs"
4. I. Panageas (advisors: P. Tetali and F. Dellaert): "Preconditioning in the non-Laplacian case"
5. L. Xin (advisors: D. Goldberg and A. Shapiro): "Moment convergence rate in stochastic optimization"

SPRING 2012

1. K. Chandrasekaran (advisor: S. Vempala): "The complexity of the cutting plane method"
2. N. Chenette (advisor: S. Boldyreva): "Efficient fuzzy searchable encryption"
3. A. Galanis (advisor: E. Vigoda): "Phase transitions in the complexity of counting"
4. J. Yu (advisor: O. Ergun): "Atomic congestion games with taxes on resources"

(Lists of previous winners can be found on the ARC website.) During the ARC annual events, the students supported by ARC make poster presentations.

Education

Besides supporting competitive research projects put forth by graduate students by way of ARC student fellowships each term, ARC hosts expository lecture series as well as tutorials on topics of current interest. Examples include Frank Vallentin's minicourse on Modern Applications of Semidefinite Programs (September 26–October 7, 2011), Amin Coja-Oghlan's lectures on Random Constraint Satisfaction Problems (February 25–March 8, 2012), and tutorial lectures embedded in the workshops (March and June 2012). Several ARC affiliated faculty in addition delivered expository lectures on their research at various national and international venues.

Lectures

Each of the following high-profile visitors gave a series of lectures on exciting frontier research topics.

1. Frank Vallentin, Professor, Del University of Technology, The Netherlands
2. Noga Alon (Israel Prize winner), Professor, Tel Aviv University
3. Persi Diaconis (MacArthur Fellow, Fellow of AAAS), Professor, Stanford University
4. Fredrich Eisenbrand, Chair of Discrete Optimization, Ecole Polytechnique Federale de Lausanne
5. Ravi Kannan (Knuth Prize winner), Microsoft Research, Bangalore, India
6. Amin Coja-Oghlan, Professor, Goethe University, Frankfurt
7. Gil Kalai, (Rothschild Prize winner), Professor, Hebrew University and Yale University

Reading groups, seminars, and courses

ARC postdocs as well as SCS and SoM postdocs have offered joint courses during the past couple of years:

Spring 2012: Discrete Fourier Analysis by Will Perkins (NSF Postdoc, SoM), Elena Grigorescu and Lev Reyzin (postdocs supported by ARC, SCS and Simons Foundation).

Spring 2013: Advanced Topics in Algorithmic Game Theory by Jugal Garg, Ruta Mehta (ARC and NSF-funded postdocs), and Georgios Piliouras (ECE postdoc).

High-dimensional phenomena in Statistics and Machine Learning Seminar: ARC faculty Nina Balcan (SCS), Vladimir Koltchinskii (SoM), Justin Romberg (ECE) and Karim Lounici (SoM) co-organize an ongoing reading and research seminar.

Student Seminars

ACO, ARC and ISyE have been cost sharing in funding the pizza-lunch student seminar series organized and hosted by the ACO Ph.D. students for the past few years. The speakers include on-campus students, postdocs, faculty, as well as visiting researchers. The lectures are aimed at non-specialists and have been a very effective tool in the ongoing learning process of the relevant community.

Workshops and Outreach

Modern Aspects of Submodularity
March 19-22, 2012

Organizers: Shabbir Ahmed (ISyE), Nina Balcan (SCS), Satoru Iwata (Kyoto), and Prasad Tetali


Georgia Tech Algorithms & Randomness Center

Modern Aspects of Submodularity

March 19-22, 2012 : Klaus 1116

ORGANIZING COMMITTEE: **Shabbir Ahmed** (School of ISyE, GaTech), **Nina Balcan** (School of CS, GaTech), **Satoru Iwata** (RIMS, Kyoto University), and **Prasad Tetali** (School of Math and School of CS, GaTech)

Workshop Theme:
Submodular functions are discrete analogues of convex functions, arising in various fields of computer science and operations research. Since the seminal work of Jack Edmonds (1970), submodularity has long been recognized as a common structure of many efficiently solvable combinatorial optimization problems. Recent algorithmic developments in the past decade include combinatorial strongly polynomial algorithm for minimization, constant factor approximation algorithms for maximization, and efficient methods for learning submodular functions. In addition, submodular functions find novel applications in combinatorial auctions, machine learning, and social networks. This workshop aims at providing a forum for researchers from a variety of backgrounds for exchanging results, ideas, and problems on submodular optimization and its applications. The first day will be devoted to tutorial-style lectures!

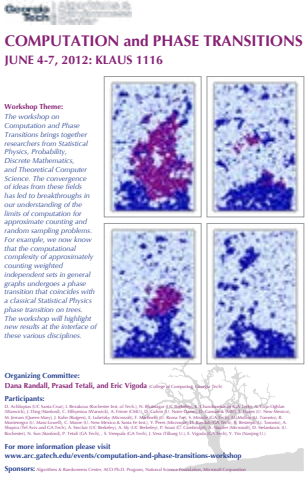
Confirmed Speakers: **Jeff Bilmes** (U. of Washington), **Chandra Chekuri** (UIUC), **Satoru Fujishige** (Kyoto University), **Gagan Goel** (Google Research), **Michel Goemans** (MIT), **Carlos Guestrin** (CMU), **Satoru Iwata** (Kyoto University), **Kamal Jain** (e-Bay), **Andreas Krause** (ETH), **Andrei Krokhin** (Durham University, UK), **Jon Lee** (U. Michigan), **Tom McCormick** (UBC), **Aranyak Mehta** (Google Research), **Vahab Mirrokni** (Google Research), **Kazuo Murota** (U. of Tokyo), **Kiyohito Nagano** (U. of Tokyo), **Maurice Queyranne** (UBC), **Prasad Raghavendra** (GaTech), **Amin Saberi** (Stanford), **Akiyoshi Shioura** (Tohoku University), **Maxim Sviridenko** (IBM), **Zoya Svitkina** (Google), **Jan Vondrak** (IBM), **Laszlo Vegh** (GaTech).

Day 1 (3/19) : Tutorial Lectures by A. Krause, K. Murota, and J. Vondrak
For additional information, please visit the ARC website:
http://www.arc.gatech.edu/events/arc-submodularity-workshop

Sponsors: Algorithms & Randomness Center, ACO Ph.D. Program, School of ISYE, School of Math, IMA (Minnesota), **Google Corp., Microsoft Corp., Yandex Corp.** (Russia)

This workshop brought together the very top researchers in the topic from academia as well as industry members (Google, IBM, Microsoft), and was funded by Georgia Tech, the Institute of Mathematics and Applications (IMA, Minnesota), Microsoft Research, and the Yandex Corporate (Russia). Day one included six hours of tutorial lectures by three leading experts. See details: www.arc.gatech.edu/events/arc-submodularity-workshop

Computation and Phase Transitions
June 4-8, 2012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COMPUTATION and PHASE TRANSITIONS
JUNE 4-7, 2012: KLAUS 1116

Workshop Theme:
The workshop on Computation and Phase Transitions brings together researchers from Statistical Physics, Probability, Discrete Mathematics, and Theoretical Computer Science. The convergence of ideas from these fields has led to breakthroughs in our understanding of the limits of computation for approximate counting and random sampling problems. For example, we now know that the computational complexity of approximately counting weighted independent sets in general graphs undergoes a phase transition that coincides with a classical Statistical Physics phase transition on trees. The workshop will highlight new results at the interface of these various disciplines.

Organizing Committee:
Dana Randall, Prasad Tetali, and Eric Vigoda (College of Computing, Georgia Tech)

Participants:
D. Achlioptas (UC Santa Cruz), I. Dinaburg (Rochester Inst. of Tech.), N. Bhatnagar (UC Berkeley), A. Frieze (Carnegie Mellon), E. Lubetzky (Courant), C. Moore (Santa Fe Institute), D. Randall (Georgia Tech), A. Sinclair (UC Berkeley), P. Tetali (Georgia Tech), E. Vigoda (Georgia Tech), D. Weitz (Princeton), D. Wilson (Microsoft), L. Ding (Stanford), C. Efthymiou (Warwick), A. Frieze (CMU), Q. Gaboa (U. Santa Barbara), D. Gamarnik (MIT), D. Gamarnik (IBM), D. Gamarnik (U. New Mexico), M. Jerrum (Queen Mary), J. Kahn (Rutgers), E. Lubetzky (Microsoft), F. McSweeney (U. Rome Tor), A. Montanari (Stanford), M. Molloy (U. Toronto), R. Mossimpiego (U. Mass-Lowell), C. Moore (U. New Mexico & Santa Fe Inst.), C. Peyre (Microsoft), R. Raz (MIT), M. Rosenzweig (U. Toronto), A. Sinclair (UC Berkeley), D. Randall (Georgia Tech), D. Stefankovic (U. Rochester), J. Stoyanovich (CWI, Amsterdam), M. Tetali (Georgia Tech), D. Weitz (Princeton), D. Wilson (Microsoft), D. Stefankovic (U. Rochester), N. Bhatnagar (U. Berkeley), P. Frankl (GA Tech), A. Frieze (Carnegie Mellon), E. Vigoda (Georgia Tech), Y. Yin (Nanjing U.)

For more information please visit
www.arc.gatech.edu/events/computation-and-phase-transitions-workshop

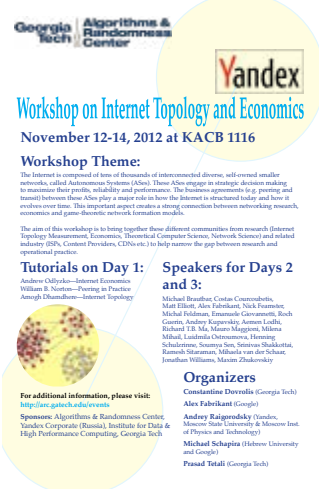
Sponsors: Algorithms & Randomness Center, ACO Ph.D. Program, National Science Foundation, Microsoft Corporation

Organizers: Dana Randall (SCS), Prasad Tetali, and Eric Vigoda (SCS)

This workshop brought together researchers from SCS, Statistical Physics, Probability and Statistics. It was funded by the NSF and Georgia Tech. See details at www.arc.gatech.edu/events/computation-and-phase-transitions-workshop

Network Topology and Economics
November 12-14, 2012

Organizers: Constanlne Dovrolis (SCS), Alex Fabrikant (Google Research), Michael Shapira (Hebrew University), and Prasad Tetali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Yandex

Workshop on Internet Topology and Economics

November 12-14, 2012 at KACB 1116

Workshop Theme:
The Internet is composed of tens of thousands of interconnected diverse, self-owned smaller networks, called Autonomous Systems (ASes). These ASes engage in strategic decision making to maximize their profits, reliability and performance. The business agreements (e.g. peering and transit) between these ASes play a major role in how the Internet is structured today and how it evolves over time. This important aspect creates a strong connection between networking research, economics and game-theoretic network formation models.

The aim of this workshop is to bring together these different communities from research (Internet Topology Measurement, Economics, Theoretical Computer Science, Network Science) and related industry (ISPs, Content Providers, CDNs etc.) to help narrow the gap between research and operational practice.

Tutorials on Day 1:
Andrew Odlyzko—Internet Economics
William B. Norton—Peering in Practice
Amogh Dhamdhere—Internet Topology

Speakers for Days 2 and 3:
Michael Brautbar, Costas Courcoubetis, Matt Elliott, Alex Fabrikant, Nick Feamster, Michal Feldman, Emanuele Giovannetti, Roch Guerin, Andrey Kupavskiy, Aemen Lodhi, Richard T.B. Ma, Mauro Maggioni, Milena Mihail, Luidmila Ostroumova, Henning Schulzrinne, Soumya Sen, Srinivas Shakkottai, Ramesh Sitaraman, Mihaela van der Schaar, Jonathan Williams, Maxim Zhukovskiy

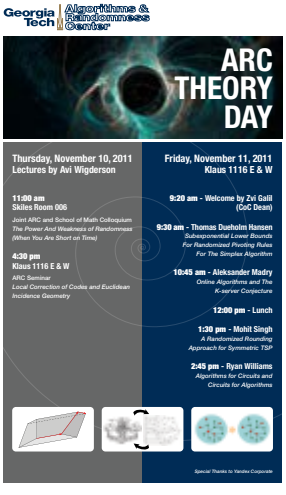
Organizers
Constantine Dovrolis (Georgia Tech)
Alex Fabrikant (Google)
Andrey Raigorodskiy (Yandex, Moscow State University & Moscow Inst. of Physics and Technology)
Michael Schapira (Hebrew University and Google)
Prasad Tetali (Georgia Tech)

For additional information, please visit:
http://arc.gatech.edu/events

Sponsors: Algorithms & Randomness Center, Yandex Corporate (Russia), Institute for Data & High Performance Computing, Georgia Tech

The workshop brought together the communities of Network Economics and Internet Topology. It was primarily funded by a grant from the Russian search engine company Yandex Corporate, along with support from ARC and Institute for Data and High Performance Computing (IDH). See details at www.arc.gatech.edu/events/arc-yandex-workshop-internet-topology-and-economics

ARC Theory Day
November 11, 2011



Speakers included the Institute for Advanced Study (IAS) Permanent member Avi Wigderson, and four younger award-winning paper authors from theoretical SCS community: Thomas Hansen (Germany), Alexandr Madry (Microsoft Research), Mohit Singh (McGill University), and Ryan Williams (Stanford University). All lectures were videotaped and archived and made available through the GaTech library resources. See details at www.arc.gatech.edu/events/arc-theory-day

Theory Day II was held for April 9, 2013.

ARC-RIM Industry Day
May 4, 2012

The objective is in bringing together leading researchers/ developers from industry with leading researchers from academia to discuss challenges, opportunities and new trends in logistics, physical material flow, optimization, and related algorithms. See details at www.robotics.gatech.edu/content/arc-rim-industry-day

Industry Day II was held for April 25, 2013.

ARC 5 Annual Day

Noga Alon is a Baumritter Professor of Mathematics and Computer Science in Tel Aviv University, Israel. He won the Israel Prize (2008) and the EMET prize (2001). A more complete list of his accomplishments is at: www.tau.ac.il/~nogaa/

Persi Diaconis is the Mary Sunseri Professor at Stanford in the Department of Statistics and Professor of Mathematics. He is a MacArthur fellow and his full list of achievements and awards can be found at: www-stat.stanford.edu/~cgates/PERSI/cv.html

In line with the previous ARC annual event has attracted a large audience. This year's event featured two very distinguished, highly recognized scientists: Noga Alon and Persi Diaconis. Their lectures were accompanied by talks on recent technical contributions by three Georgia Tech faculty: Greg Blekherman (SoM), Frank Dellaert (SIC), and Justin Romberg (ECE). ARC Student Fellowship winners made presentations over a catered lunch session.

Grants and External Support

The $1.08 million 3-year NSF grant secured by the ARC faculty Randall, Tetali, Vempala, and Vigoda came to a successful completion by September 2012. Besides this grant, the following industrial sponsors together contributed about $50K towards various workshops hosted during 2012: Yandex Corporate (Russia), Microsoft Research, and Google Research. In addition, the Institute for Mathematics and Applications (IMA), Minnesota, and the Schools of Mathematics and ISyE, as well as the Institute for Data and High-Performance Computing (IDH) on campus, have played a role in supporting some of the workshops that ARC has hosted during 2012.

INDIVIDUAL GRANTS

Various ARC faculty have received the following funding during 2012; the list is by no means exhaustive:

1. Ton Dieker (NSF CAREER: 2013-2017): "Stochastic processes in high-dimensions: from asymptotic analysis to algorithms," $400K

2. Lance Fortnow (NSF grant: 2012-2015): "Bounding rationality by computational complexity," $152K

3. Vladimir Koltchinskii (NSF grant: 2012-2015): "Complexity penalization in high-dimensional matrix estimation problems," $300K

4. Arkadi Nemirovsky (NSF grant: 2012-2015; joint with Co-PI Alex Shapiro): "Design of efficient saddle point algorithms for large-scale/ complex geometry convex optimization," $450K

5. Dana Randall (NSF grant: 2012-2015): "Markov chain algorithms for problems from computer science, statistical physics and algorithms," $280K

6. Jeff Shamma (Army Research Office/ Multidisciplinary University Research Initiative grant: 2012-2017; joint with A. Jadbabaie (PI), University of Pennsylvania, and others): Evolution of cultural norms and dynamics of socio-political change," $500K (out of a total of $6.25 Million over 5 years)

7. Robin Thomas (NSF grant: 2012-2017): "Graph structure theory and applications to algorithms," $585K

8. Vijay Vazirani: (NSF grant: 2012-2016; joint with John Ledyard (CalTech Economist)): $600K (out of a total of $700K)

9. Santosh Vempala: (NSF grant: 2012-2015): "Fundamental high-dimensional algorithms based on convex geometry and spectral methods," $420K

10. Eric Vigoda: (NSF grant: 2012-2015): "Phase transitions in approximate counting problems," $383K

INSTITUTE SUPPORT

Following presentations by the ARC director during the past year, the Deans of CoC, CoE and CoS as well as the Executive Vice President for Research (EVPR) have expressed strong enthusiasm for supporting ARC for the next cycle of 5 years (2012-2017), subject to a successful review after two years (during 2014). Pledges include $50K (CoC), $35K (CoE), and $35K (CoS) for fiscal year (FY) 2013 and FY 2014. EVPR's office contributed $50K for FY 2013 and is currently considering ARC's budget request for FY 2014.

NSF Expeditions: Collaborative Proposal Algorithms for 21st Century Challenges

A team of Georgia Tech faculty in collaboration with several distinguished external scientists made a concerted effort in putting together a very strong proposal for the NSF Expeditions solicitation. The proposal is currently under review.

GOALS AND CHALLENGES

The goal is to tackle algorithmic challenges of the current century. The project proposes to identify gaps between several well-identified challenges and the state-of-the-art in theory and practice, and develop algorithmic techniques to bridge these gaps, via the following focus topics: Integer Programming, Convex Optimization, Matrix Estimation and Analysis, Phase Transitions in Random Structures and Algorithms and (real world) Industry Challenges. Statistical learning theory, machine learning algorithms and randomness (in instances and in algorithm design) play a fundamental cross-cutting role in all of the above topics; a further opportunity and challenge is to develop, analyze, and harness methods that optimize with provable accuracies, and provide problem-specific guarantees. The research outlined in the proposal is expected to yield novel and fundamental optimization and algorithmic techniques with far-reaching impact.

PERSONNEL

To address these challenges a diverse team was assembled whose research expertise ranges from different aspects of theory to various application domains, with several researchers experienced in both ends of the spectrum. The team consists of Prasad Tetali (PI), and Co-PIs Henrik Christensen (SIC), Vladimir Koltchinskii (SOM), George Nemhauser (ISyE), Arkadi Nemirovski (ISyE) Dana Randall (SCS), Justin Romberg (ECE), Santosh Vempala (SCS) from Georgia Tech. External Co-PIs include: Avrim

Blum (SCS) and Alan Frieze (SoM) from Carnegie Mellon University, Pankaj Agarwal (SCS) from Duke University, Vojtech Rodl (SoM) from Emory University, and Shang-Hua Teng (SCS) from University of Southern California. Senior Personnel on the proposal include distinguished scientists, Noga Alon (Tel Aviv University), Bill Cook (University of Pittsburgh), Jennifer Chayes (Director of Microsoft Research-New England and New York City), Ravi Kannan (Microsoft Research-Bangalore), Joel Spencer (Courant Institute, New York University), as well as Andrea Lawrence (SCS) from Spelman College.

EDUCATIONAL AND PROFESSIONAL TRAINING COMPONENT

The team also proposed to offer a Masters degree in advanced and applied aspects of Algorithms and training a new generation of students with an interdisciplinary skill set. Mentoring students at the Spelman College in placing them in the Georgia Tech College of Computing Masters program is an important first step in what the team hopes to be transformative in bringing some of the local colleges up-to-speed.

ENDORSEMENTS

The proposal was enthusiastically endorsed with letters of support by visionaries and influential scientists, including Emmanuel Candes (Stanford), Richard Karp (University of California Berkeley, Simons Institute), Craig Mundie (Microsoft Research), Fadil Santosa (IMA Director), and Sebastian Thrun (Stanford and Google Research).

ADDITIONAL HIGHLIGHTS and RECOGNITIONS

NEW RECRUITS AND INDUCTEES

Jugal Garg and Ruta Mehta have been hired as ARC postdocs, after they have successfully defended their dissertations at the Indian Institute of Technology, Mumbai, India. Consistent with much of the ARC (financial support) model, while an ARC faculty (Professor Vazirani) funds one of the postdocs using NSF funding, the other one is supported by matching funds from ARC.

New inductees as ARC faculty include Lance Fortnow (Chair of SCS), Sebastian Pokutta (ISYE) and Greg Blekherman (SoM).

RECENT PRIZES AND ACHIEVEMENTS

Nina Balcan, Ton Dieker and Chris Peikert were awarded the NSF CAREER awards.

Greg Blekherman was awarded the Alfred P. Sloan Fellowship in Mathematics in 2012.

Ton Dieker received The Erlang Prize from the Applied Probability Society of Institute for Operations Research and the Management Sciences (INFORMS) for outstanding contributions to several areas, including the theory of stochastic processes, stochastic networks, and stochastic analysis of algorithms.

ARC Faculty Bill Cook, Dana Randall, Prasad Tetali and Robin Thomas have been recognized as American Mathematics Society Fellows in 2012.

Ruta Mehta's Ph.D. thesis titled "Nash Equilibrium Computation in Various Games" received the Association for Computing Machinery (ACM) India Dissertation Award, 2012. Thesis submitted in academic years 2010–2011 and 2011–2012 were considered for the competition.

Lance Fortnow published a book—*The Golden Ticket: P, NP and the search for the impossible*. Princeton University Press, Princeton, 2013. It was chosen as the "Nota Bene" book of the week in the Chronicle of Higher Education Review.

ARC DIRECTOR'S NOTE

In summary, during 2012 ARC faculty organized several high quality research workshops, hosted high profile scientists who have collaborated with Georgia Tech faculty, students and postdocs. ARC continued to catalyze and foster cross campus collaborations, keeping its commitment to playing an Algorithms ThinkTank role. ARC has kept the focus on research at all levels (undergraduate included), while contributing to the educational mission of Georgia Tech by hosting tutorials and expository lectures by experts and established scientists.

ACKNOWLEDGMENTS

EXPERT ADMIN SUPPORT

ARC director and ARC faculty gratefully acknowledges the very valuable support that Ms. Elizabeth Ndongi continues to provide on many ARC matters. Without her able support the management of the center and various logistics would be that much harder.

ARC director and Theory faculty are also thankful to the generous help and support Ms. Dani Denton provides, particularly during the hosting of workshops and special events.

Annette has no business helping ARC, but has been invaluable to the ARC director on many matters, including website maintenance, workshop registration and coordination with ACO events. Ms. Annette Rohrs in the School of Mathematics is undoubtedly an inspiration to every Georgia Tech employee. Thank you, Annette!