## Algorithmic Game Theory

1. **Network Effects of Risk Behavior Change following Prophylactic Intervention**
   with R. Rajaraman, Z. Sun and A. Vullikanti.
   To appear in *PLOS ONE* 2013.

2. **Cache me if you can: Capacitated Selfish Replication Games**
   with R. Gopalakrishnan, N. Karuturi, D. Kanoulas, C. Pandurangan and R. Rajaraman.
   Proceedings of *LATIN* 2012.

3. **Existence Theorems and Approximation Algorithms for Generalized Network Security Games**
   with V. S. Anil Kumar, R. Rajaraman and Z. Sun.
   Proceedings of *IEEE ICDCS* 2010.

4. **Reducibility among Fractional Stability Problems**
   with S. Kintali, L. Poplawski, R. Rajaraman and S. Teng.
   Proceedings of *IEEE FOCS*, pp. 283-292, 2009.

5. **Bounded Budget Connection (BBC) Games or how to make Friends and Influence People on a Budget**
   with N. Laoutaris, L. Poplawski, R. Rajaraman and S. Teng.
   Proceedings of *ACM PODC*, pp. 165-174, 2008.
   Presents a game-theoretic formulation of the problem of forming connections in a social network.

## Confluent Flows

6. **The Confluent Capacity of the Internet: Congestion vs. Dilation**
   with J. Chen, M. V. Marathe and R. Rajaraman.
   Proceedings of *IEEE ICDCS*, 5, 2006. (Best Paper Award)
   Simple randomized scheme for achieving confluent flow with near optimal congestion and dilation in preferential attachment graphs.

7. **(Almost) Tight bounds and Existence Theorems for Confluent Flows**
   with J. Chen, R. Kleinberg, L. Lovasz, R. Rajaraman and A. Vetta.
   Proceedings of *Symposium on Theory of Computing (STOC)*, pp. 529-538, 2004. The paper is accepted to the *Journal of the ACM*.
   Tight upper and lower (log n) bounds on the congestion of a confluent flow are proved.

8. **Meet and Merge: Approximation Algorithms for Confluent Flows**
   with J. Chen and R. Rajaraman.

Proceedings of *Symposium on Theory of Computing (STOC)*, pp. 373-382, 2003. The paper was invited to, and appeared in, a special issue of the *Journal of Computer Systems and Sciences* 72(3), pp. 468-489, 2006.

The notion of a confluent flow, introduced in this paper, characterizes Internet flows. A constant factor hardness result and a √n approximation algorithm are presented for the minimum congestion of a confluent flow.

## Universal Approximations

9. **Group-independent Spanning Tree for Data Aggregation in Dense Sensor Networks**
   with L. Jia, G. Noubir and R. Rajaraman.
   Proceedings of *IEEE DCOSS*, pp. 282-304, 2006.
   Universal algorithm and associated protocol for data aggregation in sensor networks embedded on the plane.

10. **Universal approximations for TSP, Steiner tree and set cover**
    with L. Jia, G. Lin, G. Noubir and R. Rajaraman.
    *Symposium on Theory of Computing (STOC)*, pp. 386-395, 2005.
    A Sigma-2 model for approximation algorithms. Polylog approximation algorithms for metric TSP and Steiner tree.

## Internet

11. **Maygh: Building a CDN from client web browsers**
    with L. Zhang, F. Zhou and A. Mislove.
    Proceedings of *ACM/EuroSys*, 2013.

12. **Prediction of arrival of Nodes in a Scale-free Network**
    with V. Mahantesh, S. Iyengar, M. Vijesh, S. Nayak and N. Shenoy.
    Proceedings of *ACM/IEEE ASONAM*, 2012.

13. **WebCloud: Recruiting Web Users for Content Distribution**
    with F. Zhou, E. Franco, L. Zhang, R. Revis and A. Mislove.
    Proceedings of *NCA*, 2012.

14. **Home is where the (Fast) Internet is: Flat-rate Compatible Incentives for Reducing Peak Load**
    with P. Chhabra, N. Laoutaris and P. Rodriguez.
    Accepted to *ACM SIGCOMM Workshop on Home Networking, HOMENETS'10*, 2010.

15. **Algorithms for Constrained Bulk-Transfer of Delay-Tolerant Data**
    with P. Chhabra, V. Erramilli, N. Laoutaris and P. Rodriguez.
    Accepted to *IEEE ICC*, 2010.

16. **Delay Tolerant Bulk Data Transfers on the Internet**
    with N. Laoutaris, G. Smaragdakis and P. Rodriguez.
    Proceedings of *ACM SIGMETRICS*, pp. 229-238, 2009.
    Using store-and-forward to improve the transfer of bulk data over the Internet.

17. **Scaling Laws for the Internet over Urban Regions**
with V. S. Anil Kumar, M. Marathe, M. Thakur and S. Thulasidasan.
Accepted to CAIDA's *ISMA WIT*, (Short Paper) 2006.
A study of the topology of the Internet over metropolitan areas.

18. **Towards a Topology Generator Modeling AS Relationships**
with X. Dimitropoulos, G. Riley and D. Krioukov.
Proceedings of *IEEE International Conference on Network Protocols (ICNP)*, (Short Paper) 2006.
A generator for AS-level graphs that captures inter-AS relationships.

19. **A methodology for estimating inter-domain web traffic demand**
with A. Feldmann, O. Maennel, N. Kammenhuber, B. Maggs and R. de Prisco.
Proceedings of *Internet Measurement Conference (IMC)*, pp. 322-335, 2004.
Estimation of inter-domain traffic combining CDN data with trace data.

## Network design and performance

20. **Minimum energy accumulative routing in wireless networks**
with J. Chen, L. Jia, X. Liu and G. Noubir.
Proceedings of *INFOCOM*, vol. 3, pp. 1875-1886, 2005.
Bounds (upper and lower) on accumulative energy routing.

21. **Managing a portfolio of overlay paths**
with D. Antonova, A. Krishnamurthy and Z. Ma.
Proceedings of *Networking and Operating Systems Support for Digital Audio and Video (NOSSDAV)*, pp. 30-35, 2004.
A mean-variance framework for optimizing overlay paths.

22. **Improving minimum cost spanning trees by upgrading nodes**
with S.O. Krumke, M.V. Marathe, H. Noltemeier, R. Ravi, S.S. Ravi and H-C. Wirth.
*Journal of Algorithms*, 33(1), pp. 92-111, 1999.

23. **Improving spanning trees by upgrading nodes**
with S.O. Krumke, H. Noltemeier, H-C. Wirth, M.V. Marathe, R. Ravi, and S.S. Ravi.
*Theoretical Computer Science*, 221(1-2), pp. 139-155, 1999. A preliminary version appeared in *International Colloquium on Automata, Languages and Programming (ICALP)*, LNCS 1256, pp. 281-291, 1997.

24. **Bicriteria network design problems**
with M.V. Marathe, R. Ravi, S.S. Ravi, D. Rosenkrantz and H. Hunt.
*Journal of Algorithms*, 28(1), pp. 142-171, 1998. A preliminary version appeared in *International Colloquium on Automata, Languages and Programming (ICALP)*, LNCS 944, pp. 487-498, 1995.

25. **Improved results on service-constrained network design problems**
with M.V. Marathe and R. Ravi.

*Network Design: Connectivity and Facilities Location*, P.M. Pardalos and D.Z. Du, editors, DIMACS Series, Vol. 40, AMS, pp. 269-276, 1998.

26. **A note on optical routing**
    with R. Panigrahy, Ravi Kumar and A. Russell.
    *Information Processing Letters*, 62, pp. 295-300, 1997.

27. **Service-constrained network design problems**
    with M. V. Marathe and R. Ravi.
    *Nordic Journal of Computing*, 3(4), pp. 367-387, 1996. A preliminary version appeared in *Scandinavian Workshop on Algorithm Theory (SWAT)*, LNCS 1097, pp. 28-40, 1996.

28. **Spanning trees short or small**
    with R. Ravi, M.V. Marathe, D. Rosenkrantz and S.S. Ravi.
    *SIAM Journal of Discrete Mathematics*, 9(2), pp. 178-200, 1996. A preliminary version (with a coda!) appeared in *ACM-SIAM Symposium on Discrete Algorithms (SODA)*, pp. 546-555, 1994

## Latin Squares

29. **On completing Latin Squares**
    with Iman Hajirasouliha, Hossein Jowhari and Ravi Kumar.
    *Symposium on Theoretical Aspects of Computer Science (STACS)*, 2007.

30. **Approximating Latin square extensions**
    with Ravi Kumar and A. Russell.
    *Algorithmica*, 24(2), pp. 128-138, 1999. A preliminary version appeared in *International Conference on Computation and Combinatorics (COCOON)*, LNCS 1090, pp. 280-289, 1996.

31. **Faster algorithms for optical switch configurations**
    with Ravi Kumar and A. Russell.
    *IEEE International Conference on Communications (ICC)*, pp. 1320-1324, 1997.

## Security

32. **Scheduler Vulnerabilities and Coordinated Attacks in Cloud Computing**
    with F. Zhou, M. Goel and P. Desnoyers.
    To appear in *Journal of Computer Security.* Preliminary version appeared in NCA 2011.

33. **SamaritanCloud: Secure and Scalable Infrastructure for enabling Location-based Services**
    with A. Samanta and F. Zhou.
    Proceedings of *IFIP Networking*, 2013. One of 6 papers selected from 50 for special issue of Computer Communications Journal.

34. **Evaluating Encrypted Boolean Functions on Encrypted bits: Secure decision-making on the Black side**

with R. Krishnan.
Proceedings of *SPIE DSS*, 2013.

35. **Optimization of Directional Antenna Network Topology in Airborne Networks**
    with G. Hadynski, S. B. Lee, G. Rajappan, X. Wang and F. Zhou.
    Proceedings of *IEEE MILCOM*, 2010.

36. **Policy-Agile Encrypted Networks Via Secure Function Computation**
    with R. Krishnan.
    Proceedings of *IEEE MILCOM*, 2010.

37. **HARD-DNS: Highly-Available Redundantly-Distributed DNS**
    with C. Gutierrez, R. Krishnan and F. Zhou.
    Proceedings of *IEEE MILCOM*, 2010.

38. **Jamming Steganography using Steganography: Prevention of Data Exfiltration using Steganographic Techniques**
    with K. Bertolino.
    Proceedings of *IEEE International Conference on Technologies for Homeland Security*, 2008.

39. **A Game-Theoretic Framework for Bandwidth Attacks and Statistical Defenses**
    with M. Snyder and M. Thakur.
    Proceedings of *IEEE LCN (Local Computer Networks) Conference*, 2007.

40. **SPREAD: Foiling Jammers using Multi-Layer Agility**
    with X. Liu, G. Noubir and S. Tan.
    Proceedings of *INFOCOM Minisymposium,* 2007.
    Idea for foiling jammers by mechanism hopping across layers using cryptographic coordination.

41. **Steganographic Communication in Ordered Channels**
    with Ch. Ravi Chandra, A. Kumarasubramaniam, G. Noubir, C. Pandu Rangan and R. Manokaran.
    Proceedings of *Information Hiding, IH2006,* LNCS, 2006.
    Estimation of the amount of information that can be embedded in the sequencing of packets in an ordered channel, such as TCP. Optimal codes with encoding/decoding algorithms are provided and an open problem due to Lehmer is resolved.

42. **Batching Schnorr Identification Scheme with Applications to Privacy-Preserving Authorizations and Low-Bandwidth Communication Devices**
    with R. Gennaro, D. Leigh and W. Yerazunis.
    Proceedings of *AsiaCrypt,* LNCS pp. 276-292, 2004.
    A generalization of Schnorr's zero knowledge scheme to multiple identities is presented. Details of a smart card implementation using bi-directional LEDs are given. The scheme allows for an efficient transfer of privileges from one smart card to another.


# Complexity theory

43. **Alternation in interaction**
     with M. Kiwi, C. Lund, A. Russell and D. Spielman.
     *Computational Complexity*, 9(3-4), pp. 202-246, 2000. A preliminary version appeared in *IEEE Conference on Structure in Complexity Theory*, pp. 294-303, 1994.

44. **A note on the asymptotics and computational complexity of graph distinguishability**
     with A. Russell.
     *Electronic Journal of Combinatorics, 5(1), R23*, 1998.

45. **Symmetric alternation captures BPP**
     with A. Russell.
     *Computational Complexity*, 7(2), pp. 152-162, 1998. A preliminary version appeared in *Workshop on Interactive Proof Systems,* Weizmann Institute, Israel, 1995.
     We introduce $S_2$ – a complexity class that captures symmetric alternation and prove a number of interesting facts about this class. Ran Canetti independently discovered $S_2$. Later Cai proved a very interesting result about this class and Sengupta observed that in the tightest form of the famous Karp-Lipton theorem, the polynomial-time hierarchy collapses to $S_2$. Read all about it in Lance Fortnow's complexity theory blog where it attained the status of "complexity class of the week" for the week of August 28, 2002.

46. **The relationship between probabilistically checkable debate systems, IP and PSPACE**
     with A. Russell.
     *Information Processing Letters*, 53(2), pp. 61-68, 1995.


## Miscellaneous

47. **PhoneGuard: A smartphone in the coalmine**
     with N. Mayor, F. Wagen and A. Samanta.
     Proceedings of *ACM ACWR (International Conference on Wireless Technologies for Humanitarian Relief)*, 2011.
48.
49. **Preprocessing DNS Log Data for Effective Data Mining**
     with M. Snyder and M. Thakur.
     Proceedings of *IEEE ICC (International Conference on Communications)*, 2009.

50. **MOVARTO: Virtual Server Migration across Networks using DNS and Route Triangulation**
     with N. Faber.
     *VMWorld* 2007.
     Extends the concept of OS virtualization to network virtualization.

51. **Unweaving a web of documents**
     with R. Guha, Ravi Kumar and D. Sivakumar.
     Proceedings of *Knowledge Discovery and Data Mining (KDD),* pp. 574-579, (Short Paper) 2005.
     Algorithms for decomposing a collection of time-stamped documents into threads.

52. **Expressiveness and complexity of crosscut languages**
     with K. Lieberherr and J. Palm.

Accepted to *FOAL*, 2005.
Algorithms and hardness results for a class of crosscut languages.

**53. A note on embedding complete graphs into hypercubes**
  with M. Klugerman and A. Russell.
*Discrete Mathematics*, 186, pp. 1-3, 1998.
It is shown that complete graphs of size n can be embedded into hypercubes so as to minimize the sum of edge dilations in a uniform way for all n except n =4 and n = 8. This explains the anomalous factor of approximation obtained for a natural algorithm for the multicut problem. This was the first paper to give me an Erdos number of 2; Mike Klugerman has coauthored a paper with Erdos.

**54. Treewidth of circular-arc graphs**
  with K.S. Singh and C.P. Rangan.
*SIAM Journal of Discrete Mathematics*, 7(4), pp. 647-655, 1994. A preliminary version appeared in *Workshop on Algorithms and Data Structures (WADS)*, LNCS 519, p. 41, 1991.
Treewidth is a graph measure defined by Robertson and Seymour in the course of their celebrated graph minor project. The treewidth of a graph characterizes the complexity of many computational problems on that graph. Here we present the first polynomial time algorithms for computing the treewidth of the class of intersection graphs of arcs on a circle.

**55. Efficient parallel shuffle recognition**
  with M. Nivat, G.D.S. Ramkumar, C.P. Rangan and A. Saoudi.
*Parallel Processing Letters*, 4(4), pp. 455-463, 1994. A preliminary version appeared in *International Parallel Processing Symposium (IPPS)*, pp. 112-115, 1992.

**56. Optimal path cover problem on block graphs and bipartite permutation graphs**
  with R. Srikant, K.S. Singh and C.P. Rangan.
*Theoretical Computer Science*, 115(2), pp. 351-357, 1993.
This paper presents the first polynomial-time algorithms for minimizing the number of paths needed to cover block graphs and bipartite permutation graphs.

**PhD Thesis**
MIT, 1996.
Goes from verse (see acknowledgement) to bad.