

Faculty Summary, 2017–2018
Clifford Stein
Department of IEOR
Joint Department: Computer Science

I. Research

A. Major Research Fields and Current Projects:

Fields: Design and analysis of algorithms, combinatorial optimization, scheduling, green computing, e-commerce, network algorithms, big data, algorithm engineering.

Current Projects: Scheduling Computers while Minimizing Energy. Scheduling Networks While Minimizing Energy. On-line Matching. Better Algorithms for Maximum and Minimum-Cost Flow. Massively Parallel Algorithms.

B. Current and Pending Grants

Current

- 2017-2020: *AF:Small:Beyond Worst Case Running time: Algorithms for Routing, Scheduling and Matching*, NSF CCF, \$490,000, administered by DSI.
- 2017-2020: *TRIPODS:From Foundations to Practice of Data Science and Back*., NSF CCF, \$1,500,000, co-PI, administered by DSI.
- 2014-2018: *AF:Small: Scheduling and Routing: Algorithms with novel cost measures*, NSF CCF, \$417,277.
- 2017-2018: *SODA 2017 Travel Grant*, NSF CCF, \$20,000, administered by DSI.
- 2018: *SODA 2018 Travel Grant*, NSF CCF, \$15,000, administered by DSI.

Pending

- 2018-2021: *SPX: Collaborative Research: Secure and Massive Parallel Computing*, NSF CCF, co-PI, \$333,333 out of a requested \$1,000,000.
- 2018-2022: *SCC: FITSCommute - A Smart Transit Service Using Social Network Based Ridesharing*, NSF, co-PI, total of \$3,000,000 requested

C. Invited seminars, key speaker and plenary lectures.

- Matching on Large Data Sets, Rutgers, April, 2018
- Matching on Large Data Sets, Princeton, April, 2018
- Minimizing Maximum Flow Time via Posted Prices, Simons Institute for Theoretical Computer Science, December, 2017
- Minimizing Maximum Flow Time via Posted Prices, Models and Algorithms for Planning and Scheduling Problems, June, 2017

D. Honors or Awards Received.

E. Publications

Appeared

- *Max-min fair rate allocation and routing in energy harvesting networks: algorithmic analysis.* with Jelena Marasevic and Gil Zussman. In *Algorithmica*, 2017.
- *Scheduling When You Don't Know the Number of Machines.* with Mingxian Zhong. In the proceedings of the *29th Symposium on Discrete Algorithms*, 2018.
- *Minimizing Maximum Flow Time on Related Machines via Dynamic Posted Pricing.* with Sungjin Im, Benjamin Moseley, and Kirk Pruhs. In the proceedings of the *European Symposium on Algorithms*, 2017.
- *Extending Search Phases in the Micali-Vazirani Algorithm.* with Michael Huang. In the proceedings of *Symposium on Experimental Algorithms*, 2017.
- *An $O(\log \log m)$ -Competitive Algorithm for Online Machine Minimization.* with Sungjin Im, Benjamin Moseley, and Kirk Pruhs. In the proceedings of *39th Real Time System Symposium*, 2017.

Accepted

- *Fast Algorithms for Knapsack via Convolution and Prediction.* with MohammadHossein Bateni, MohammadTaghi Hajiaghayi, and Saeed Seddighin. To appear in the proceedings of STOC 2018.
- *The Online Set Aggregation Problem.* with Rodrigo A. Carrasco, Kirk Pruhs, and Jos Verschae. To appear in the proceedings of LATIN 2018.

Submitted

- *Dynamic Matching: Reducing Integral Algorithms to Approximately-Maximal Fractional Algorithms.* with Moab Arar, Shiri Chechik, Sarel Cohen, and David Wajc. Submitted to ICALP, 2018.
- *MapReduce Meets Fine-Grained Complexity: MapReduce Algorithms for APSP, Matrix Multiplication, 3-SUM, and Beyond.* with Mohammadtaghi Hajiaghayi, Silvio Lattanzi, Saeed Seddighin, and Sergei Vassilvitskii. Submitted to SPAA, 2018.
- *Coresets Meet EDCS: Algorithms for Matching and Vertex Cover on Massive Graphs.* with Sepehr Assadi, MohammadHossein Bateni, Aaron Bernstein, and Vahab S. Mirrokni. Submitted to FOCS, 2018.
- *Parallel Graph Connectivity in Log Diameter Rounds.* with Alexandr Andoni, Zhao Song, Zhengyu Wang, and Peilin Zhong. Submitted to FOCS, 2018.

F. Key metrics or mechanisms to asses the impact of your research The key metrics are, in rough order of importance

- Publication in competetive conferences
- Citations
- Publication in top journals

II. Teaching and Advising

A . Courses Taught 2016-2107

- Fall 2016: Scheduling Algorithms, Enrollment: 15.
- Spring 2017: Production Scheduling, Enrollment, 53. Applied Intenger Programming, Enrollment, 35.

B . Courses Taught 2017-2018

- Fall 2017: Analysis of Algorithms, Enrollment: 145.
- Spring 2018: Production Scheduling, Enrollment, 40. Foundations of Data Science, Enrollment, 22.

C . Courses Expected to Teach 2018-2010

- Fall 2017: Introduction to Optimization.
- Spring 2018: ??

D. Undergraduate Advising.

- Michal Huang
- Christine Chang
- Shawn Xia

E. Graduate Advising

1. Ph.D.s completed in last 5 years.

- Rodrigo Carrasco, Columbia IEOR (joint with G. Iyengar) , *Resource Cost Aware Scheduling Problems*, May, 2013, 4 years in program.
- Tulia Humphries, Columbia IEOR (joint with J. Sethuraman), *On the Kidney Exchange Problem and Online Minimum Energy Scheduling*, May, 2014, 6 years in program.
- Andrei Simion, Columbia IEOR (joint with M. Collins), *A Family of Latent Variable Convex Relaxations for IBM Model 2*, May 2015, 5 years in program.
- Rhea Qin, Columbia IEOR (joint with Yuan Zhong), *Approximation Algorithms for Demand-Response Contract Execution and Coflow Scheduling*, February, 2016, 6 years in program.
- Aaron Bernstein, Columbia CS, *Dynamic Algorithms for Shortest Paths and Matching*, August 2017, 6 years in program.
- Jelena Marasevic, Columbia EE (joint with Gil Zussman), *Resrouce Allocation in Wireless Networks: Theory and Practice*, August 2017, 5 years in program.

2. Ph.Ds in progress.

- Mingxian Zhong, Columbia IEOR (joint with M. Chudnovsky), 5th year, expected completion, 2018.
- Nourhan Sakr, Columbia IEOR, 4rd year, expected completion, 2019.

- Mohammad Sradavan, Columbia IEOR (joint with Shipra Agarwal), 4rd year, expected completion, 2020.
- Pelin Zhong, Columbia CS (joint with Alex Andoni and Rocco Servedio), 2nd year, expected completion, 2021.
- Sandip Sinha, Columbia CS (joint with Alex Andoni and Mihalis Yannakakis), 2nd year, expected completion, 2021.
- Sai Mali Ananth, Columbia IEOR, 1st year, expected completion, 2022.
- Oussama Hanguir, Columbia IEOR, 1st year, expected completion, 2022.

5.

- Franziska Eberle, Visiting Ph.D. Student, University of Bremen, 3 months.

III. Service

A. Service to the Department

- Ph.D. Committee, 2013–2019.
- Faculty Search Committee Chair 2013–2014, Member, 2014–2015, Chair, 2015–2016, Member, 2016–2018
- Undergraduate Committee, 2013–2018.

B. Service to Columbia

- Committee to Design an Undergraduate Data Science Course, Chair, 2016–present.
- SEAS Academic Review, Cochair, 2018.
- SEAS Executive Committee, 2016–present.
- Data and Society Taskforce, 2016–present.
- Provosts Grant Program for Junior Faculty who Contribute to the Diversity Goals of the University, 2017–present.
- Packard Fellowship committee, 2017
- DSI M.S. admissions committee, 2013–present.
- DSI Space committee, 2015–2017.
- IDSE lecturer hiring committee, 2013–2014.
- Shared Research Computing Policy Advisory, 2011-present.

C. Service to the General Community

- Organizing Committee, Dagstuhl Scheduling Workshop, 2018
- Program Committee Member, ESA, European Symposium on Algorithms, 2017.
- Program Committee Member, WAOA, Workshop on Approximation and Online Algorithms, 2017.

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- Program Committee Member, SPAA, Symposium on Parallel Algorithms and Architectures, 2015.
- Program Committee Member, SEA, Symposium on Experimental Algorithms, 2015.
- Organizing Committee Member, ISMP, Approximation and Online Algorithms Track, 2015
- Steering Committee Chair: SODA, Symposium on Discrete Algorithms, 2013-present.
- Steering Committee Member: ALENEX, Algorithm Engineering and Experimentation, 2014-present
- Steering Committee Member: MAPSP, Models and Algorithms for Planning and Scheduling Problems, 2009-present.
- Organizer, Dagstuhl Workshop on Scheduling, 2016.
- Associate Editor, ACM Books, 2014-2017.

IV. Resources-Research

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A. Utilization

- I use my office and my students use their offices. I do not use any additional significant space.
- I do not use any shared laboratory space, other than the CS department machines occasionally.
- I use the office staff in IEOR for routine work. I use the DSI staff for help in preparing grants.

B. Needs Research space in IEOR is cramped, we would benefit with more space, especially for students and postdocs and visitors.

V. Resources - Teaching

A. Resources I use the electronic podium in classrooms, my personal web site, and courseworks. Better resources for communicating with and between students would be helpful. I have sufficient TA support.

B. Needs The biggest need is classroom space. There is not enough room for all the students in some of the classes, or we need to limit enrollment severely. It would be very useful to have larger classrooms, especially for exams, when you really need to have the students separated, which is currently impossible to achieve.

VI. Additional Information

- I developed the sophomore level *Foundations of Data Science* course, designed for SEAS sophomore students. I taught it for the first time this spring.