Hamoon Mousavi

CONTACT INFORMATION

Simons Institute
University of California, Berkeley

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EDUCATION

Ph.D., Computer Science, Columbia University, New York, NY, USA **August 2023**

Advisor: Prof. Henry Yuen

Thesis: *Some Aspects of Noncommutativity in Polynomial Optimization*

M.S., Mathematics (C&O), University of Waterloo, Waterloo, Canada **December 2019**

Advisor: Prof. Debbie Leung

Thesis: *Lower-Bounds on the Length of Regular Expressions*

M.S., Computer Science, University of Waterloo, Waterloo, Canada **August 2013**

Advisor: Prof. Jeffrey Shallit

Thesis: *Repetition in Words*

B.S., Computer Engineering, University of Tehran, Tehran, Iran **August 2011**

EMPLOYMENT

Postdoctoral Fellow, Simons Institute, UC Berkeley, CA, USA **August 2023–August 2025**

Software Engineer, Alphabet Inc. (Google), Waterloo, Canada **February 2016–March 2018**

Software Engineer, Startup (Marmot Labs), Waterloo, Canada **June 2015–February 2016**

Software Engineer, Intel Corporation (McAfee), Waterloo, Canada **August 2014–June 2015**

Research Assistant, University of Waterloo, Waterloo, Canada **August 2013–August 2014**

INTERESTS

My research focuses on quantum computing and complexity, particularly in optimization and approximation. To address quantum-inspired optimization problems, I develop tools that integrate ideas from random matrix theory, the representation theory of algebras, polynomial optimization, and semidefinite programming.

RECOGNITION

QIP Long Plenary Talk **2022**

Canada Graduate Scholarship (CGS-D NSERC) **2020–2023**

Ontario Graduate Scholarship (OGS) **2019–2020**

SERVICE

Program Committee Member: QIP **2025**

Seminar Co-Organizer: Quantum Colloquium, Simons Institute **2024**
Quantum Colloquium is a series of public lectures attracting top researchers.

Seminar Co-Organizer: Formal Languages and Automata, University of Waterloo **2011-2014**

Publications

15. HM and Taro Spirig, *A quantum unique games conjecture*, ITCS 2025 and QIP 2025.

14. Eric Culf, HM, and Taro Spirig, *Approximation algorithms for noncommutative CSPs*, FOCS 2024 and QIP 2025.

13. HM, Seyed Sajjad Nezhadi, and Henry Yuen, *Nonlocal games, compression theorems, and the arithmetical hierarchy*, QIP 2022 Plenary and STOC 2022.

12. William Helton, HM, Seyed Sajjad Nezhadi, Vern Paulsen, and Travis Russell, *Synchronous values of games*, Tsirelson Memorial Workshop 2022 and Annales Henri Poincaré 2024 (vol. 25, pp. 4357–4397).

11. HM, Seyed Sajjad Nezhadi, and Henry Yuen, *On the complexity of zero-gap MIP**, ICALP 2020 and TQC 2020.

10. David Cui, Arthur Mehta, HM, and Seyed Sajjad Nezhadi, *A generalization of CHSH and the algebraic structure of optimal strategies*, QIP 2020 and Quantum Journal 2020 (vol. 4).

9. Chen Fei Du, HM, Eric Rowland, Luke Schaeffer, and Jeffrey Shallit, *Decision algorithms for Fibonacci-automatic words, II: Related sequences and avoidability*, Theoretical Computer Science 2017 (vol. 657(B), pp. 146-162).

8. Chen Fei Du, HM, Luke Schaeffer, and Jeffrey Shallit, *Decision algorithms for Fibonacci-automatic words, III: Enumeration and abelian properties*, International Journal of Foundations of Computer Science 2016 (vol. 27(8), pp. 943-963).

7. HM, Luke Schaeffer, and Jeffrey Shallit, *Decision algorithms for Fibonacci-automatic words, I: Basic results*, Theoretical Informatics and Applications 2016 (vol. 50(1), pp. 39-66).

6. Daniel Goc, HM, Luke Schaeffer, and Jeffrey Shallit, *A new approach to the paperfolding sequences*, Conference on Computability in Europe (CiE) 2015.

5. HM and Jeffrey Shallit, *Mechanical proofs of properties of the tribonacci word*, Conference on Combinatorics on Words (WORDS) 2015.

4. HM and Jeffrey Shallit, *Shortest repetition-free words accepted by automata*, Workshop on Descriptional Complexity of Formal Systems (DCFS) 2013.

3. Daniel Gŏc, HM, and Jeffrey Shallit, *On the number of unbordered factors*, Conference on Languages and Automata Theory and Applications (LATA) 2013.

2. HM and Jeffrey Shallit, *Repetition avoidance in circular factors*, Conference on Developments in Language Theory (DLT) 2013, Lecture Notes in Computer Science.

1. HM and Jeffrey Shallit, *Filtrations of formal languages by arithmetic progressions*, Fundamenta Informaticae 2013 (vol. 123(2), pp. 135-142).

Preprints

2. HM, *Lower bounds on the length of regular expressions*, 2017.
1. HM, *Automatic theorem proving in Walnut*, 2016.

Invited Talks

29. Computer Science Department at Stony Brook, Stony Brook, NY — January 24, 2025
Constraint satisfaction in the quantum setting

28. Theory Lunch, Columbia University, New York, NY — January 17, 2025
Constraint satisfaction in the quantum setting

27. CS Theory Seminar, NYU, New York, NY — January 9, 2025
A quantum unique games conjecture

26. ITCS, Columbia University, New York, NY — January 7, 2025
A quantum unique games conjecture

25. Quantum Pod Seminar, Simons Institute, Berkeley, CA — December 5, 2024
What is Label-Cover to our QMA?

24. IQUIST Seminar, University of Illinois Urbana-Champaign, Urbana, IL — December 3, 2024
Algebras, CSPs, and quantum computing

23. Quantum Working Group Seminar, — December 2, 2024
University of Illinois Urbana-Champaign, Urbana, IL
Two open problems in noncommutative polynomial optimization

22. CS Theory Lunch, University of Washington, Seattle, WA — November 22, 2024
Constraint satisfaction in the quantum world

21. Quantum Computing Seminar, Harvard, Cambridge, MA — November 14, 2024
Noncommutativity, CSPs, and quantum computation

20. MIT, Cambridge, MA — November 13, 2024
Algebras, CSPs, and quantum computation

19. Post-FOCS Mini Theory Workshop, UChicago/TTIC, Chicago, IL — October 31, 2024
Noncommutativity, CSPs, and quantum computation

18. FOCS, Chicago, IL — October 29, 2024
Approximation algorithms for noncommutative CSPs

17. Probabilistic Operator Algebra Seminar, UC Berkeley, Berkeley, CA — April 23, 2024
An application of free probability in the study of noncommutative CSPs

16. Meet the Fellows, Simons Institute, Berkeley, CA — September 8, 2023
Noncommutative constraint satisfaction problems

15. Workshop on Rounding Schemes for Quantum Optimization, June 27, 2023
    Simons Institute, Berkeley, CA
    Noncommutativity and rounding schemes for combinatorial optimization, Parts I & II

14. IRIF, Paris, France February 28, 2023
    Noncommutativity for combinatorial optimization

13. ENS Lyon, Lyon, France February 23, 2023
    Noncommutativity for combinatorial optimization

12. QIT Seminar, ETH, Zurich, Switzerland February 21, 2023
    Noncommutativity for combinatorial optimization

11. QLunch, QMATH, University of Copenhagen, Copenhagen, Denmark February 14, 2023
    Noncommutativity for combinatorial optimization

10. QuSoft Seminar, CWI, Amsterdam, Netherlands February 3, 2023
    Noncommutativity for combinatorial optimization

9. QIP Plenary, Caltech, Pasadena, CA March 2022
   Nonlocal games, compression theorems, and the arithmetical hierarchy

8. University of Ottawa, Ottawa, Canada December 10, 2021
   Quantum correlations from finite groups

7. ICALP, Saarbrücken, Germany July 9, 2020
   *On the complexity of zero gap MIP**

6. QIP, Shenzhen, China January 10, 2020
   A generalization of CHSH and the algebraic structure of optimal strategies

5. The 18th Bellairs Crypto-Workshop, Barbados March 7, 2019
   Applications of non-local games to quantum PCP

4. DCFS, Western University, London, Canada July 2013
   Shortest repetition-free words accepted by automata

3. CanaDAM, Memorial University of Newfoundland, St. John's, Canada June 2013
   Repetition avoidance in circular factors

2. Workshop on Challenges in Combinatorics on Words April 2013
   Fields Institute, Toronto, Canada
   Repetition avoidance in circular factors

1. LATA, Bilbao, Spain July 2013
   On the number of unbordered factors