Yuchong Pan

Contact Information

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Research Interests

Algorithms, combinatorics, optimization, theoretical computer science, graph theory.

Education

Massachusetts Institute of Technology

Ph.D., Applied Mathematics, expected 2026
- Advisor: Michel X. Goemans

University of British Columbia

B.Sc., Computer Science and Mathematics, Honours, with Distinction, 2021
- Thesis: *Optimization Problems on Network Flows with Degree Constraints*
- Advisor: F. Bruce Shepherd

Employment

Massachusetts Institute of Technology

Graduate Research Assistant, Aug 2024–Dec 2024
Graduate Research Assistant, Jun 2024–Jun 2024
Graduate Teaching Assistant, Feb 2024–May 2024
Mentor for PRIMES-USA, Jan 2024–Jan 2025
Mentor for DRP, Jan 2024–Feb 2024
Mentor for PRIMES-USA, Jan 2023–Jan 2024
Graduate Research Assistant, Sep 2023–Dec 2023
Mentor for RSI, Jun 2023–Aug 2023
Residential Counselor for $\sqrt{}$mathroots, Jun 2023–Jul 2023
Graduate Teaching Assistant, Feb 2023–May 2023
Mentor for DRP, Jan 2023–Feb 2023
Graduate Teaching Assistant, Sep 2022–Dec 2022
Mentor for SPUR+, Jun 2022–Aug 2022
Mentor for DRP, Jan 2022–Feb 2022

University of British Columbia

Research Assistant, Apr 2021–Aug 2021
Undergraduate Teaching Assistant, Jan 2021–Apr 2021
Undergraduate Teaching Assistant, Aug 2020–Dec 2020
Undergraduate Academic Assistant, Oct 2019–Mar 2020
Undergraduate Teaching Assistant, Sep 2019–Dec 2019
Student Assistant, Centre for Accessibility, Jan 2019–Apr 2019
Undergraduate Teaching Assistant, Sep 2018–Dec 2018

Microsoft Corporation

Software Engineer Intern, May 2020–Aug 2020
Software Engineer Intern, Jun 2019–Aug 2019

Software Engineer Intern, May 2018–Aug 2018

Sogou, Inc.

Software Engineer Intern, May 2017–Jul 2017

InitialView

Software Engineer Intern, Aug 2016–May 2017

Teaching Experience

Massachusetts Institute of Technology

Teaching Assistant (Recitation Instructor)

18.06	Linear Algebra, Spring 2024

Teaching Assistant (Grader)

18.453/4531	Combinatorial Optimization, Spring 2023
18.085/0851	Computational Science and Engineering I, Fall 2022

University of British Columbia

Teaching Assistant

CPSC 420	Advanced Algorithms Design and Analysis, Spring 2021
CPSC 311	Definition of Programming Languages, Fall 2020
CPSC 421/501	Introduction to Theory of Computing, Fall 2019
CPSC 121	Models of Computation, Fall 2018

Academic Assistant

CPSC 411	Introduction to Compiler Construction, Fall 2019–Spring 2020 *Assisted redesigning the course, supervised by William J. Bowman.*

Mentoring Experience

Massachusetts Institute of Technology

Program for Research in Mathematics, Engineering and Science for High School Students (PRIMES-USA, remote), Jan 2024–Jan 2025.

- Students: Christopher K. Bao (Davidson Academy, Reno, NV), Joshua T. Wang (Brookfield Central High School, Brookfield, WI), William Zhao (Dougherty Valley High School, San Ramon, CA)
- Topic: Approximate Minimum Cuts in Graphs and Hypergraphs
- A poster titled *A Faster Approximation Algorithm for the k-Way Cut Problem in Low-Rank Hypergraphs via Multiplicative Weight Update* is to be presented by Christopher K. Bao in the AMS-PME Undergraduate Student Poster Session at the Joint Mathematics Meetings (JMM) 2025.
- A poster titled *Improved Analysis of the Branching Contraction Algorithm for the Unweighted Hypergraph Minimum k-Way Cut Problem* is to be presented by Joshua T. Wang in the AMS-PME Undergraduate Student Poster Session at the Joint Mathematics Meetings (JMM) 2025.
- A poster titled *Upper and Lower Bounds on Several Cut Numbers in Hypergraphs via Randomized Contraction* is to be presented by William Zhao in the AMS-PME Undergraduate Student Poster Session at the Joint Mathematics Meetings (JMM) 2025.

Directed Reading Program (DRP), Jan 2024–Feb 2024.

- Students: Jennifer Ai, Neha Pant
- Book: *Algorithmic Game Theory* edited by N. Nisan, T. Roughgarden, É. Tardos and V. V. Vazirani

Program for Research in Mathematics, Engineering and Science for High School Students (PRIMES-USA, remote), Jan 2023–Jan 2024.

- Student: Ruiyang (Raymond) Luo (University High School, Irvine, CA)
- Topic: Cyclic Basis Orderings and Equitability of Matroids
- Ruiyang (Raymond) Luo attends Massachusetts Institute of Technology after high school.

Research Science Institute (RSI), Jun 2023–Aug 2023.

- Student: Alan Bu (Phillips Exeter Academy, Exeter, NH)
- Topic: Connections Between Concatenations of Two Incidence Matrices and Spanning Trees in Planar Graphs
- This project was selected as one of the top 5 out of 100 oral presentations.
- Alan Bu won the 10th place (with a $\$40,000$ scholarship) in the 83rd Regeneron Science Talent Search (STS) for this project.
- Alan Bu attends Harvard University after high school.

Research Science Institute (RSI), Jun 2023–Aug 2023.

- Student: Deyan Hadzhi-Manich (High School of Mathematics "Dr. Petar Beron", Varna, Bulgaria)
- Topic: Lower and Upper Bounds on Longest Geometrically Increasing Sequences
- Deyan Hadzhi-Manich attends Harvard University after high school.

Directed Reading Program (DRP), Jan 2023–Feb 2023.

- Students: Tianze Jiang, Wayne Zhao
- Book: *Beyond the Worst-Case Analysis of Algorithms* edited by T. Roughgarden

Extended Summer Program in Undergraduate Research (SPUR+), Jun 2022–Aug 2022.

- Students: Evgeniya Artemova, Christina Yu
- Topic: Lower Bounds on the Discrete Newton's Algorithm for the Submodular Line Search Problem

Directed Reading Program (DRP), Jan 2022–Feb 2022.

- Students: Sualeh Asif, Aparna Gupte
- Book: *Randomized Algorithms* by P. Raghavan and R. Motwani

Volunteering Experience

THE Hack (InnoCat Technology Co., Ltd.)

Co-Founder, Chief Technology Officer and Co-Director of Corporate Relations, Feb 2017–Jul 2018.

Shaoxing No.1 High School

Coach for Competitive Programming Summer Camp, July 2016–July 2016

Student Lecturer on Competitive Programming, 2013–2015

Manuscripts

- Branching contractions revisited: tighter running time bound on simple unweighted hypergraphs (with J.T.Wang). *Submitted.*
- A local-adjustment algorithm for the Győri-Lovász theorem on biconnected graphs. *Submitted.*
- On high-value and high-flow cycles at basic feasible solutions of subtour elimination relaxations for the symmetric and asymmetric traveling salesman problems (with M.X. Goemans). *Submitted.*
- Planarity via spanning tree number: a linear-algebraic criterion (with A. Bu). *Submitted.*
- A counterexample to box-half-integrality of the intersection of crossing submodular flow systems (with M.X. Goemans). 2023. *Unpublished.*
- Optimization problems on network flows with degree constraints. Undergraduate honours thesis, University of British Columbia, 2021.

Expository Articles

- r-arborescences, spanning trees, extended formulations and total dual integrality (with D. Jin). Project of MIT 18.456J (Algebraic Techniques and Semidefinite Programming), 2023.
- From bounded degree to bounded arboricity (with J. Rodríguez Figueroa). Project of MIT 6.5240 (Sublinear Time Algorithms), 2022.
- Randomization in recent progress on traveling salesman problem. Project of MIT 6.842 (Randomness and Computation), 2022.
- Summary: round trip spanners and roundtrip routing in directed graphs. Project of MIT 6.890 (Graph and Matrix Algorithms), 2021.
- A spectral method for the sensitivity conjecture. Project of UBC CPSC 531F (Topics in the Theory of Computing: Applications of Linear Algebra), 2021.
- Unsplittable flow problem on paths and trees: closing the LP relaxation integrality gap (with A. Jozefiak). Project of UBC CPSC 531F (Tools for Modern Algorithm Analysis), 2019.

Talks and Presentations

- From submodular flows to planar graphs: a planarity criterion inspired by an OR question. The 7th YinzOR Conference, Tepper School of Business, Carnegie Mellon University. Pittsburgh, PA. August 23, 2024.
- Planarity via spanning tree number: a linear-algebraic criterion. Algorithms Seminar, Department of Computer Science, University of British Columbia. Vancouver, BC. May 23, 2024.
- Fantastic spanning trees in planar graphs and where to find them. Simple Person's Applied Math Seminar (SPAMS), Department of Mathematics, Massachusetts Institute of Technology. Cambridge, MA. October 12, 2023.
- Perturbation-stable maximum cuts. Algorithms Reading Group, Department of Computer Science, University of British Columbia. Online. June 30, 2020.

Honors and Awards

- Graduation with Distinction, University of British Columbia, 2021.
- Science Scholar, University of British Columbia, 2021.
- Dean's Honour List, University of British Columbia, 2021.
- Work Learn International Undergraduate Research Award (CAD $6,000), University of British Columbia, 2021.
- Stanley M Grant Scholarship in Mathematics (CAD $1,500), University of British Columbia, 2021.
- Faculty of Science International Student Scholarship (CAD $7,500), University of British Columbia, 2020.
- J Fred Muir Memorial Scholarship in Science (CAD $200), University of British Columbia, 2020.
- Trek Excellence Scholarship (CAD $4,000), University of British Columbia, 2020.
- Science Scholar, University of British Columbia, 2020.
- Dean's Honour List, University of British Columbia, 2020.
- Faculty of Science International Student Scholarship (CAD $5,000), University of British Columbia, 2019.
- Dean of Science Scholarship (CAD $350), University of British Columbia, 2019.
- Trek Excellence Scholarship (CAD $4,000), University of British Columbia, 2019.
- Stanley M Grant Scholarship in Mathematics (CAD $1,500), University of British Columbia, 2019.
- Science Scholar, University of British Columbia, 2019.
- Dean's Honour List, University of British Columbia, 2019.
- Faculty of Science International Student Scholarship (CAD $10,000), University of British Columbia, 2018.
- Dean of Science Scholarship (CAD $425), University of British Columbia, 2018.
- Trek Excellence Scholarship (CAD $4,000), University of British Columbia, 2018.

- Marie Kendall Memorial Scholarship in Science (CAD $925), University of British Columbia, 2018.
- Joel Harold Marcoe Memorial Scholarship (CAD $150), University of British Columbia, 2018.
- Science Scholar, University of British Columbia, 2018.
- Dean's Honour List, University of British Columbia, 2018.
- 27th Place (out of 118 teams), North American Invitational Programming Contest, Open Division (USA + Canada), 2018.
- 11th Place (out of 67 teams), ACM International Collegiate Programming Contest, Pacific Northwest Regional (Division 1), 2017.
- Outstanding International Student Award (CAD $6,000), University of British Columbia, 2017.
- Silver Medal, National Olympiad in Informatics Top Competition, China Computer Federation, 2015.
- Bronze Medal, Asia-Pacific Informatics Olympiad, China Computer Federation, 2015.
- First Prize, National Olympiad in Informatics in Provinces (Grades 10–12 Division), China Computer Federation, 2014.
- First Prize, National Olympiad in Informatics in Provinces (Grades 10–12 Division), China Computer Federation, 2013.
- Second Prize, National Olympiad in Informatics in Provinces (Grades 7–9 Division), China Computer Federation, 2012.
- Second Prize, National Olympiad in Informatics in Provinces (Grades 7–9 Division), China Computer Federation, 2011.

Professional Service

Journal Review

SIAM Journal on Discrete Mathematics (SIDMA)
Mathematical Programming, Series B

Conference Review

The 25th Conference on Integer Programming and Combinatorial Optimization (IPCO 2024)
The 2022 Annual ACM-SIAM Symposium on Discrete Algorithms (SODA 2022)

Relevant Skills

Languages: English, Mandarin
Programming: LaTeX, Python, Julia, C/C++, Java, C#, MATLAB, JavaScript, Go, Racket, Standard ML, MySQL

Last Updated

November 5, 2024