# Peter Bradshaw

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Citizenship: USA

I am a graph theory researcher and PhD candidate advised by Bojan Mohar and Ladislav Stacho. My interests include graph coloring, rainbow graph structures, and games on graphs. I also take great pride in teaching math to students of all levels.

## EDUCATION

**PhD., Mathematics,** Simon Fraser University, GPA: 4.17/4.33                                    Sep 2020 — Summer 2022
- Thesis: *Graph coloring with additional restrictions*, advised by Bojan Mohar and Ladislav Stacho

**MSc., Mathematics,** Simon Fraser University, GPA: 4.13/4.33                                    Sep 2018 — Aug 2020
- Thesis: *Cops and robbers on Cayley graphs and embedded graphs*, advised by Ladislav Stacho

**B.S., Mathematics,** University of Kansas, GPA: 3.82/4.00                                    2012 — 2016

## EMPLOYMENT

**Research Assistant at Simon Fraser University**                                    **Jan 2019 — Present**
- Worked with Bojan Mohar and Ladislav Stacho carrying out graph theoretic research and writing papers

**Teaching Assistant at Simon Fraser University**                                    **Sep 2018 — Present**
- Tutored in quantitative, algebra, and applied calculus workshops, consistently receive high reviews
- Led weekly tutorials for Math 342 (Number Theory) and Math 348 (Probability)

**Cambridge teacher of Math and Physics at Zhengzhou No. 47 High School**                                    **Aug 2016 - Jun 2018**
- Led classes as a primary instructor and prepared students to take Cambridge exams in Math (IGCSE and A-Level) and Physics (IGCSE)

## SELECTED PUBLICATIONS AND PREPRINTS

1. Bradshaw, P. Graph colorings with restricted bicolored subgraphs: I. Acyclic, star, and treewidth colorings. *Accepted to JGT.*

   *This paper uses the Lovász Local Lemma to show that a graph of maximum degree $\Delta$ has a coloring using $O\left(\Delta^{\frac{m}{m-1}}\right)$ colors so that every connected subgraph of at least $m$ edges receives at least three colors. This generalizes a famous result of Alon, McDiarmid, and Reed showing that a graph of maximum degree $\Delta$ can be acyclically colored with $O\left(\Delta^{4/3}\right)$ colors. A probabilistic construction is used to show that this upper bound is tight within a factor of less than $\log \Delta$.*

2. Bradshaw, P. Graph colorings with restricted bicolored subgraphs: II. The graph coloring game. *Accepted to JGT.*

   *This paper proves that given graphs $G$ and $H$ of game coloring number at most $t$, the game chromatic number of the Cartesian product $G \square H$ is less than $t^5$, answering a question of X. Zhu. The main tool for this new result is a generalization of a method of Dinski and Zhu that shows that the game chromatic number of a graph $G$ is at most $a(G)(a(G) + 1)$, where $a(G)$ is the acyclic chromatic number of $G$.*

3. Bradshaw, P., Hosseini, S. A., Mohar, B. & Stacho, L. Cops and robbers on graphs of high girth. *Accepted to JGT.*

   *This paper shows that graphs of girth $g$ and minimum degree $\delta$ have cop number $\Omega\left(g^{-1}(\delta-1)^{\frac{1}{4}g}\right)$, improving the classical lower bound $\Omega\left((\delta-1)^{\frac{1}{8}g}\right)$ of Frankl from 1987. Additionally, using Ramanujan graphs, spectral graph theoretic tools, and a probabilistic strategy, the paper shows that this exponential factor cannot be increased past $\frac{3}{8}$.*

4. Bradshaw, P., Hosseini, S. A. & Turcotte, J. Cops and robbers on directed and undirected abelian Cayley graphs. *Published in European J. Comb.*

   *This paper shows that the cop number of a Cayley graph on an abelian group of $n$ elements is less than approximately $0.9424\sqrt{n}$, proving that Meyniel's conjecture holds for abelian Cayley graphs. Furthermore, the paper uses a construction based on finite fields to show that this upper bound is tight within a constant factor of less than $2$.*

5. Bradshaw, P. On the hat guessing number of a planar graph class. *Submitted to JCTB.*

   *This paper proves that the hat guessing number of outerplanar graphs is bounded using a new partitioning lemma related to a Turán hypergraph density problem. The paper gives the first known upper bound for the hat guessing number of a large topologically defined graph class.*

## COMMUNITY ACTIVITIES

**Talks**
- A rainbow connectivity threshold in random graph families, *CMS Summer Meeting, Eurocomb*    2021
- Flexible list colorings in graphs with special degeneracy conditions, *ISAAC, SFU Discrete Math Seminar*    2020
- Graphs with large cop number, *SFU Discrete Math Seminar, UBC Discrete Math Seminar*    2019
- A proof of Meyniel's conjecture for abelian Cayley graphs, *SFU Discrete Math Seminar, CanaDAM, CMS Summer Meeting*    2019

**Journal and conference referee** J. Graph Theory, Elec. J. Comb., Disc. Applied Math., SIDMA, Eurocomb 2021

## AWARDS

- Department of Mathematics graduate scholarship - $3800    2021
- Travel and research award - $700    2021
- Travel and research award - $880    2020
- Graduate fellowship - $6500    2019
- Graduate entrance scholarship - $5000    2018

## GRADUATE LEVEL CLASSES AND GRADES

- Graph Theory (A+)
- Combinatorics (A)
- Topological graph theory (A)
- Topology (A+)
- Number Theory (A+)
- Cryptography (in progress)
- Real Analysis (A)
- Algebraic Geometry (A)

## LANGUAGE SKILLS

- English (native USA)
- Spanish (proficient, IB 7/7)
- Mandarin (proficient, HSK 6/6)
- Cantonese (proficient, use daily)
- German (can read German math papers)