

Emily Cairncross

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Goal-driven PhD candidate with extensive experience in mathematical computer science methods and drive to apply knowledge and problem-solving skills. Adept at communicating technical ideas to broad audiences as evidenced by 7+ conference talks, 3+ poster presentations, and talks to undergraduates.

EDUCATION

PhD in Mathematical Computer Science | University of Illinois at Chicago (UIC) | Chicago, IL | May 2026

- Related coursework: **Mathematical Theory of Artificial Intelligence, Mathematical Foundations of Data Science, Combinatorial Optimization**

BA in Mathematics | Oberlin College | Oberlin, OH | May 2021

- GPA: 4.09/4.0
- Minors: **Computer Science**, Linguistics, Hispanic Studies, Religious Studies

EXPERIENCE

Extremal Combinatorics Research Assistant | UIC | Chicago, IL | May 2022 – present

- Analyzed connections between local and global structure in networks working 20 hrs/wk
- Generalized results of previous paper to both colored and ordered analogs, corrected a significant error in a published paper, and published results in *SIAM Journal on Discrete Mathematics*
- Worked with fellow graduate student to extend recent results to more difficult setting, submitted for publication
- Applications: coding theory, modern communications

Modeling & Analysis Intern | Carbon Solutions LLC | June – July 2023

- Analyzed data on sedimentary basins, carbon capture and storage, and multiple types of geothermal power generation to better understand different ways to reach national climate goals
- Presented findings to entire company and published in *Frontiers in Energy Research* as first author

Data Science Trainee | INMAS | October 2022 – February 2023

- Completed 40+ hrs of intensive training workshops in coding, statistical methods, and machine learning
- Built airplane boarding simulation in Python from scratch, ran on randomly generated inputs corresponding to standard boarding strategies, and presented results including practicality of implementation
- Collaborated with team of other PhD students to analyze and present housing datasets for Gary, Indiana using Python package pandas

Graph Theory Undergraduate Researcher | SMALL REU | Williams College | June – August 2020

- Collaborated researching throttling on directed graphs 7 hrs/day
- Discovered analogs for many major theorems, presented work at 3 conferences, and published paper
- Applications: quantum control in physics, monitoring electrical systems in electrical engineering

Coding Theory Undergraduate Researcher | REU at University of Michigan at Dearborn | May – July 2019

- Collaborated researching toric surface codes 7 hrs/day and presented progress biweekly
- Extended previous results to higher dimensions, presented work at 4 conferences, and published paper

LEADERSHIP

Mathematics Graduate Students Association (MGSA) Co-President | UIC | Chicago, IL | May 2022 – May 2023

- Acted as liaison between graduate students and department
- Organized weekly graduate student research seminar in spring
- Coordinated weekly Math Teas for graduate students, faculty, and staff to support department connection

SKILLS

Coding skills: C++, Python (numpy, scipy, matplotlib, pandas), Java, Eclipse, Sage, Mathematica, LaTeX

Statistical skills: Stochastic processes, Markov chain Monte Carlo, Principal component analysis (PCA)