# Rayan K. Ibrahim

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ibrahimr@lafayette.edu

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| **RESEARCH INTERESTS** | Extremal and structural graph theory. Applications of graph theory to topology and the natural sciences. Cellular automata and infection processes on graphs ($r$-neighbor bootstrap percolation). |

## EMPLOYMENT

**Visiting Assistant Professor of Mathematics**, Lafayette College — July 2024 – Current

## EDUCATION

**Ph.D. Systems Modeling and Analysis**, Virginia Commonwealth University — August 2024
**Concentration in Discrete Mathematics**
- Dissertation: Problems in Graph Theory With Applications to Topology and Modeling RNA
- Advisors: Craig E. Larson & Allison H. Moore

**M.S. Mathematics**, Virginia Commonwealth University — May 2021

**B.S. Mathematics**, College of Staten Island — Jan. 2019
- The Verrazzano School - Selective Undergraduate Honors Program

## AWARDS & HONORS

**Outstanding Graduate Student Teaching Award** — May 2024
- Virginia Commonwealth University

## PUBLICATIONS & PREPRINTS

4. **Determinants of Simple Theta Curves**
   *Journal of Knot Theory and Its Ramifications*, with M. Elpers, A. H. Moore. *Accepted.*

3. **Bootstrap Percolation, Connectivity, and Graph Distance**
   *The Art of Discrete and Applied Mathematics*, with H. LaFayette, K. McCall. *Accepted.*

2. **Introducing 3-Path Domination**
   *Journal of Combinatorial Mathematics and Combinatorial Computing* (2024), with E. King, R. Jackson.

1. **Submesoscale Kinematic Properties in Summer and Winter Surface Flows in the Northern Gulf of Mexico**
   *Journal of Geophysical Research: Oceans* (2020), with M. Berta, A. Griffa, A. C. Haza, J. Horstmann, H. S. Huntley, B. Lund, T. M. Özgökmen, A. C. Poje.

## PUBLICATIONS IN PREPARATION

3. **2-Neighbor Bootstrap Percolation and Forbidden Induced Subgraphs**
   *In Preparation.*

2. **$r$-Neighbor Bootstrap Percolation: Complementary Prisms and Bounds**
   *In Preparation.*

1. **Minimum 2-Percolating Sets in 2-Connected, Diameter 2 Graphs**
   with H. LaFayette, K. McCall. *Submitted.*

TEACHING
EXPERIENCE

### Lafayette College

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| Math 162, Calculus II | Sp25 |
| Math 161, Calculus I | (x2) F24 |
| Math 125, Calculus for the Life Sciences | F24 |
| Math 104, A World of Mathematics | (x2) Sp25 |

### Virginia Commonwealth University (Instructor)

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| Math 200, Calculus I | F23 |
| Math 151, Precalculus | Sm21, Sm22, Sm23 |
| Math 141, Algebra with Applications | F20 |
| Math 131, Introduction to Contemporary Mathematics | Sm20 |

### Virginia Commonwealth University (TA)

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| Oper 327, Mathematical Modeling | Sp21 |
| Stat 210, Basic Practice of Statistics | F19 |
| Math 151, Precalculus | Sp20 |

PRESENTATIONS

6. **2-Neighbor Bootstrap Percolation in Graphs**. Lafayette College. (Apr. 2024)

5. **New Results On Bootstrap Percolation**. Virginia Commonwealth University Discrete Mathematics Seminar. (Nov. 2023)

4. **Determinants of Simple Theta Curves**. Joint Mathematics Meetings, AMS Contributed Paper Session on Topology. (Jan. 2023)

3. **The Structure of Graphs With Independence Number 2**. Virginia Commonwealth University Discrete Mathematics Seminar. (Feb. 2022)

2. **The Reconstruction Problem**. Virginia Commonwealth University SYSM Research Seminar. (Feb. 2021)

1. **Introducing 3-Path Domination**.
   - National Technical Institute for the Deaf, Rochester Institute of Technology. (Jul. 2018)
   - MAA MathFest 2018 Undergraduate Sessions. (Aug. 2018)
   - The Ohio State University Young Mathematicians Conference 2018. (Aug. 2018)

OUTREACH &
SERVICE

**Math Kangaroo Competition**                                                 March 21, 2024
   - Checked students in and proctored test at Virginia Commonwealth University.

**Geometry Summer Camp**, Virginia Commonwealth University          Jun. 12 – 16, 2023
   - Guided middle school students through interactive mathematics activities and demonstrations.

**Website Designer**, College of Staten Island                     Jul. 2017 – Aug. 2017
   - Funded by: NYC DYCD Summer Youth Employment Program
   - The Verrazzano Honors School and Macaulay Honors College Summer Bridge Program.

RESEARCH
EXPERIENCE

**Graduate Research Assistant**, Virginia Commonwealth University  Aug. 2021 – May 2024
- Funded by: NSF DMS–2204148, & The Thomas F. and Kate Miller Jeffress Memorial Trust, Bank of America, Trustee.
- Topology, Knot Theory, Graph Theory, Combinatorics

**Undergraduate Research Assistant**, College of Staten Island  Feb. 2017 – Jun. 2019
- Funded by: Grants from The Gulf of Mexico Research Initiative to the Consortium for Advanced Research on Transport of Hydrocarbon in the Environment (CARTHE)
- Oceanography, Data Processing and Presentation.
- Supervisor: Andrew C. Poje, PhD

**Undergraduate Researcher**, Hobart and William Smith Colleges  May 2018 – Aug. 2018
- Funded by: National Science Foundation DMS–1757616
- REU program, Graph Theory
- Supervisor: Erika L.C. King, PhD

OTHER
ACTIVITIES

**AMS Math Research Community: Trees in Many Contexts** *(Selected)*  Jun. 5 – 11, 2022
- Participant in week-long workshop with funding from the AMS and National Science Foundation DMS–1641020.

**Graph Theory Computational Discovery Lab**  May 2022 - 2024
- Participant in annual 2-week research workshop hosted at VCU with a focus on discrete mathematics and generating conjectures via automated conjecturing (The Graph Brain Project).
- Topics Explored: Graphs, Knots, and Independence (2022), Hadamard Matrices (2023), Autoconnected Graphs (2024).

**The Discrete MathemaTea**, Virginia Commonwealth University  Aug. 2022 – May 2024
- Co-organizer with Neal Bushaw.
- An informal, student led discussion group on current research.

**Math and Magic with Manjul Minicourse**  Sep. 2018 – Dec. 2018
- National Museum of Mathematics, New York, NY
- Participant in a minicourse involving magic tricks and the math behind them.

**Math Club**, College of Staten Island  Aug. 2017 – May 2018
- President and Event Organizer

**Computer Science Club**, College of Staten Island  Sep. 2016 – May 2018
- Member.

TECHNICAL
SKILLS

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| Programming: | Matlab, Python, SageMath |
| Markup: | LaTeX, HTML, CSS, Word, Excel |
| Operating Systems: | Windows, Linux |