

Arturo Ortiz San Miguel
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Personal

Date/Place of birth: December 21, 2000, San Juan, Puerto Rico

Citizenship: USA

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Education

Northeastern University, Boston MA

Fall 2023-Present

PhD in Mathematics

Brown University

May 2023

Bachelor of Science in Mathematics

Bachelor of Arts in Applied Mathematics

Relevant Courses:

At Northeastern: Algebraic Combinatorics, Discrete Geometry II, Topics in Combinatorics (Matroids, log-concave polynomials, bases exchange walk), Readings in Algebraic Geometry (Toric Varieties), Topology II, Probability & Measure, Discrete Geometry, Optimization & Complexity, Analysis II

At Harvard: Combinatorics of Symmetric Functions (Spring 2025)

At Brown: Graduate Complex Analysis, Graph Theory, Mathematical Statistics, Statistical Inference, Computational Linear Algebra, Cryptography, Number Theory, Abstract Algebra, Partial Differential Equations

Awards + Grants

College of Science Dean's Award (Northeastern) - \$5,000 2023

Hispanic Scholarship Foundation (HSF) Scholar - \$5,000 2021

Hispanic Scholarship Foundation (HSF) Scholar - \$5,000 2020

ECCO 2024 Travel Grant (NSF Sponsored) - \$1,200 2024

PhD Network Travel Grant - \$1,000 2024

Duke University Travel Grant - \$500 2022

Amazon Propel Program Magna Cum Laude 2021

Recipient for exemplary leadership and academic achievement in boot camp, selected by peers as one of the 11 recipients out of 270+ interns.

Research Experience

PhD Student Researcher

Fall 2023-Present

Advisor: Prof. Gabor Lippner, g.lippner@northeastern.edu

Maximal Number of k -cycles in a d -regular Graph

https://dmd2024.web.uah.es/files/abstracts/paper_58.pdf

- Construct the d -regular graph on n vertices with the maximum number of k -cycles
- Introduce and give formulas for non-backtracking homomorphism numbers and backtracking homomorphism numbers, respectively
- Find the d -regular graph on n vertices with the maximum number of closed non-backtracking walks of length k and the one with the most closed backtracking walks of length k
- Corollary gives a formula for the number of 4-cycles and 5-cycles of any graph in terms of its spectrum, regardless of regularity.

NYC Discrete Mathematics REU at CUNY Baruch

Summer 2022

Mentor: Prof. Matthew Junge, Matthew.Junge@baruch.cuny.edu

Non-universality in Clustered Ballistic Annihilation

Electronic Communications in Probability 28 (2023): 1-12.

<https://projecteuclid.org/journals/electronic-communications-in-probability/volume-28/issue-none/Non-universality-in-clustered-ballistic-annihilation/10.1214/23-ECP529.full>

- Proved that the critical initial density to ensure particle survival depends on both the mean and variance of the cluster size
- Introduces a variant of ballistic annihilation with superimposed clusters of stationary particles
- Solves an open problem for coalescing ballistic annihilation

Population Studies & Training Center (PSTC) Logan GIS Research Assistant 2019-2020

- Develops historical GIS maps of U.S. cities by using 1930's and 1940's census data to study the effects of segregation in present day cities.

Projects

Senators Project

2020, 2024

- Started as a project in the Applied Math Directed Reading Program (DRP) at Brown
- Uses the Singular Value Decomposition to study Puerto Rican Senators' voting patterns
- Concludes that the bipartisan Puerto Rican Senate follows a one-party system trend
- Plans to repeat this analysis every election cycle

Geometry of Gerrymandering

2021

- Different definitions of compactness for a region are analyzed, compared, and applied to voting districts of Puerto Rico using a Python script
- Proposes a method for finding unfairly gerrymandered districts

Teaching Experience

At Northeastern

Instructor of Record

Mathematical Reasoning (Intro Proofs) – Fall 2024

Teaching Assistant

Calculus for Business – Spring 2025

Linear Algebra & Differential Equations – Summer II 2024

Multivariable Calculus – Summer I 2024

Calculus II for Science & Engineering – Spring 2024

Numerical Analysis – Fall 2023

REU Mentor

Number of Interlacing Triangles of Size n – Summer 2024

Directed Reading Program (DRP) Mentor

PageRank on Supreme Court Cases – Spring 2024

Ballistic Annihilation and Real Analysis – Fall 2023

At Brown

Undergraduate Teaching Assistant

Responsibilities included mandatory weekly recitation, office hours, grading

Multivariable Calculus – Spring 2022, Fall 2021, Spring 2021

Linear Algebra – Summer 2021

Problem Solving Fellow – 2022

- Provided professors and TA's with resources to teach more effectively
- Helped change calculus placement recommendations

Matched Advising Program for Sophomores (MAPS) Mentor – 2021-2022
Academic Group Tutor – 2020

Industry Experience

Amazon Software Design Engineer (SDE) Intern – Amazon Propel Program Summer 2021
 Magna Cum Laude recipient for exemplary leadership and academic achievement in boot camp, selected by peers as one of the 11 recipients out of 270+ interns

Conference and Seminar Talks

AMS Special Session on Random Walks on Graphs and Related Parameters, JMM, 2025
 Discrete Math Days, Alcalá de Henares, Madrid, Spain, 2024
 CIMPA Research School: Bridges between Algebra & Combinatorics, Popayán, Colombia, 2024
 Northeastern Graduate Student Seminar, 2023 & 2024
 Brown Symposium for Undergraduates in the Mathematical Sciences (SUMS), 2023 – two talks
 New Connections in Math, Duke University, 2022
 Brown Undergraduate Math Colloquium, 2022

Leadership & Outreach

Graduate Student Seminar Organizer 2023-Present
 AMS Graduate Student Chapter Secretary 2023-Present
 Brown Puerto Rican Student Association President 2022-2023
 Brown Diversity and Inclusion Oversight Board (DIOB) Member 2020-2021

Skills

Languages: English (Native), Spanish (Native)
 Programming Languages: Python, Java, Julia, Mathematica, MATLAB, SQL
 Applications: AWS, Sage, LaTeX, Github, numpy, networkx, Gurobi JuMP
 Interpersonal: Teaching, Intuitive Leadership, Public Speaking, Fast Learning