Oswaldo Ramirez

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Education

Carnegie Mellon University, Pittsburgh, PA, USA **September 2021-May 2025**
Bachelor of Science in Computer Science with Additional Major in Mathematical Sciences
Specialization: Algorithms and Complexity

Presentations

Opening Speaker, *First-Generation Graduation Celebration*
Carnegie Mellon University ***May 2025***
Delivered opening remarks to students, faculty, and families at CMU's annual celebration honoring first-generation graduates. Reflected on personal journey, community involvement with FirstTogether, and national representation at the 1vyG conference.

Lecturer, *Proving Hopf's Umlaufsatz using Algebraic Topology*
Course Project for 21-360 Differential Geometry of Curves and Surfaces ***Spring 2025***
Presented a proof of the homotopy invariance of degree using covering space theory and homotopy lifting; motivated by applications in Hopf's Umlaufsatz.

Lecturer, *Cut Sparsifiers in the Streaming Model*
Course Project for 15-851 Algorithms for Big Data ***Spring 2025***
Presented state-of-the-art results on computing cut sparsifiers for undirected graphs. Proposed research directions, including proving that computing the balancedness of a directed graph requires at least m^2 space (where m is the number of edges in graph G), and exploring the construction of directed sparsifiers for balanced directed graphs in the semi-streaming model.

Lecturer, *A Dive into Pell's Equation*
Course Project for 21-441 Number Theory ***Spring 2024***
Exploration of Pell's Equation, its solutions via continued fractions, and the characterization of irrational quadratics through periodic expansions solutions.

Co-Presenter, *Importance of Mentorship in College as First-Generation*
1vyG National Conference, Brown University ***Fall 2024***
Discussed the role of mentorship and peer networks in supporting first-generation college students. Shared personal experiences and best practices from FirstTogether.

Research Experience

CMU Theory *with Professor David Woodruff and PhD student Honghao Lin* ***Spring 2025-Present***

- *Proved computing the balance of a graph in the streaming model requires at least quadratic space (via reduction from the Index problem).*
- *Developing streaming algorithms for sparsifying graphs while preserving cut balance properties.*
- *Researching space-efficient algorithms for graph problems in the streaming setting.*

CMU Robotics Institute AirLab *with Dr. Brady Moon* ***September 2023-Present***

- *Optimized algorithm for informed pathfinding by improving runtime of root-finding in a complex equation, achieving a 100x speedup in computation.*
- *Developed an algorithm for solving curve-curve-curve trochoid path problem, leveraging 2D Newton-Raphson algorithm.*
- *Currently assembling a demo using a Crazyflie quadrotor with ROS, Raspberry Pi, and Crazyswarm2 package showcasing real-time implementation of the trochoid path algorithm.*
- *Created an animated visualization using Manim to illustrate trochoid curves.*

CMU Robotics Institute AirLab *with Master's (now PhD!) student Andrew Jong* ***Spring 2023-Fall 2023***

- *Developed realistic thermal imaging for a wildfire simulation using Unreal Engine.*
- *Created a black-and-white gradient base with dynamic materials to simulate thermal visuals.*
- *Enhanced realism by incorporating thermal blurriness effects commonly seen in real infrared footage.*
- *Implemented data analysis tools (PSNR and SSIM) to compare simulation output with real-world thermal data for calibration and refinement.*

Projects

15-440 Distributed Systems, Bitcoin Miner ***Fall 2024***
Implemented a bitcoin miner using a client-server model in Golang. Coordinated how to chunk the work and distribute it to available miners.

15-386 Neural Computation, Flappy Bird Solver ***Spring 2024***
Trained an agent via deep reinforcement learning to autonomously play Flappy Bird and receive a high score consistently. Explored different design decisions such as reward model and kind of learning (e.g., Q-learning).

21-241 Matrix Algebra, PageRank and HITS Algorithm ***Fall 2022***
Examined and created algorithms in Julia from real-world datasets to assess popularity of a website based on various factors such as link popularity and damping factor. Used Markov chains and random walks to implement a page rank and HITS algorithm to produce "search results."

UIUC SOSP, T-shirt Website and Discord Bot ***Summer 2022***
Implemented in Python using Flask framework a fictional e-commerce website for selling custom t-shirts. Programmed a music bot in Python using Discord API, allowing users to request and play music in server channels.

15-112 Fundamentals of Programming, Remake of Binding of Isaac ***Fall 2021***
Programmed a version of the old game, The Binding of Isaac, in Python with the use of A path finding algorithm and graphics from Tkinter, providing a challenging and entertaining gameplay experience.*

Industry Experience

FLIP National ***Summer 2024***
Technology Fellow

- *Designed and developed FLIP National's revamped website using React and Tailwind CSS.*
- *Created a mailing list component integrated with HubSpot to streamline communication and manage user subscriptions.*
- *Constructed a contact page to improve user engagement and facilitate inquiries.*
- *Built a donation page with a secure billing component, integrating PayPal and Stripe APIs for seamless transaction processing.*

Other Experience

AtCoder Online Programming Competition	***Spring 2024***
CMU StuCo Introduction to Freestyle Rap 98-303, TA → Co-Instructor	***Fall 2022 - Fall 2023***
ACM@CMU Algorithms with a Purpose Hackathon	***Spring 2023***
Cornell SoNIC	***Summer 2022***
UIUC Summer of Side Projects	***Summer 2022***
CMU Tartan Hacks Hackathon	***Spring 2022***
William Putnam Competition	***2021 - 2024***
MIT MITES (formerly MOSTEC)	***Summer 2020***

Awards

Jorndt Scholarship ***$35,000***
Awarded to only 5 students out of a class of approximately 250; disbursed over 4 years. ***2021-2025***

Hispanic Scholarship Fund Scholar ***$15,000***
Nationally competitive scholarship with roughly 10% acceptance rate. ***2023-2025***

GEAR UP Scholarship ***$6,500***
Awarded through federally funded college access program. ***2021-2023***

Community Involvement

FirstTogether ***2021–2025***
First-generation student organization supporting mentorship, community, and professional development.

Tartan Scholars ***2021–2025***
Selective cohort program for limited-resource and first-gen students at CMU.

Theory Lunch ***2023–2025***
Weekly informal research discussion group for students interested in theoretical computer science.

Catholic Church ***2021–Present***
Participate in weekly services.