NATHANIEL SAUERBERG

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EDUCATION

Carleton College, Northfield, MN — *Sep 2016 - Jun 2020*
Class of 2020 — Overall GPA: 3.86
Majors: Mathematics and Computer Science

Budapest Semesters in Mathematics (BSM), Budapest, Hungary — *Sep 2019 - Dec 2019*
Study abroad program in mathematics — Overall GPA: 4.0

RESEARCH EXPERIENCE

Multi-Armed Bandit Algorithms for Education — Jan 2019 - Jun 2020
Mentor: Anna Rafferty

- Work with three other undergraduates to explore possible effects of using various contextual multi-armed bandit algorithms to personalize students' educational experiences based on their backgrounds
- Conduct and analyze simulations to study the algorithms' impacts on the data collected and students' learning outcomes, including whether the algorithms are fair to different groups of students
- Currently finalizing a conference paper to be submitted to Educational Data Mining on March 3rd

CS Senior Thesis: Analyzing Trajectories of Wikipedia Articles — Jan 2020 - Jun 2020
Mentor: Sneha Narayan

- Conduct a literature search and propose and complete a research project, culminating in a paper
- Our project will analyze graph structures induced by the revision histories of Wikipedia articles
- Investigate whether different classes of article have distinct characteristic patterns of editor collaboration that can be discerned using network analysis, and construct a classifier to differentiate the classes

Mathematics Senior Thesis — Jan 2020 - Mar 2020

- Independent reading; studying the basic definitions, the behavior of Kolmogorov Complexity as a function on the natural numbers, and applications of Kolmogorov Complexity to quantifying the randomness of infinite bitstrings and how this definition relates to different notions of randomness

Agent-Based Modeling of International Relations — Mar 2019 - Mar 2020
Mentor: Greg Marfleet

- Replicated Lars-Erik Cederman's seminal agent-based model of the emergence and disappearance of states with a classmate, using modern computing power and the modeling language NetLogo
- Tested the robustness of the original results to variations of the initial parameters, modeling assumptions, and experiment length and devised and implemented various extensions to the model
- Currently writing a paper to be submitted to the Journal of Artificial Societies and Social Simulation

Montana State University Computer Science REU — Jun 2019 - Aug 2019
Mentors: Brendan Mumey and Sean Yaw

- Researched the Carbon Capture and Storage Problem (CCS), a complex optimization problem
- Attempted to reduce CCS to various Steiner tree, facility location, network design, and minimum-cost network flow problems found in survey of the literature, and to reduce the other problems to CCS

· Devised various heuristic algorithms and created a framework to generate random instances of the problem to evaluate the heuristics' performance against the exact integer linear program solution

Lafayette College Mathematics REU Jun 2018 - Jul 2018
Mentors: Kathleen Ryan and Karen McCready

· Collaborated with three other undergraduates to investigate proper connectedness, proper distance, and proper diameter in edge-colored graphs
· Completely characterized the range of possible proper diameters for several graph families
· Characterized all 2-connected graphs with maximum proper diameter
· Formulated and investigated the notion of proper connectivity, generalizing proper connectedness

Version Control System GUI Design: Elegit Apr 2017 - Nov 2017
Mentor: Dave Musicant

· Worked independently to improve Elegit (a Git client allowing novices to use Git while learning its complexities and organization) by fixing bugs, adding features, and improving usability

JOURNAL PUBLICATIONS

G. Fickes, D. Green, J. Hook, K. McCready, K. Ryan, N. Sauerberg, and J. Stifano, "Proper Diameter of 2-connected Bipartite Graphs" *(Under Review)*

PEER-REVIEWED CONFERENCE PROCEEDINGS

Z. Li, L. Yee, N. Sauerberg, I. Saxson, J. Williams, and A. Rafferty, "Getting too personal(ized): The importance of feature choice in online adaptive algorithms" *Under Review*

TEACHING EXPERIENCE

Course Prefect Sep 2018 - Jun 2020
Introduction to Computer Science; Data Structures; Math of Computer Science

· Lead supplemental instruction sessions twice a week emphasizing active learning
· Create supplemental problem sets to reinforce important or difficult concepts and skills
· Help students develop expert thinking, discipline-specific skills, and understanding of context

Math Skills Center Tutor Jan 2020 - Jun 2020

· Offer drop-in tutoring sessions, helping fill in mathematical background and elucidate difficult concepts

CONFERENCE PRESENTATIONS

"Maximum proper diameter of 2-connected graphs" (2019). Undergraduate Research Special Section, Joint Mathematics Meetings 2019. Baltimore, Maryland.

"Constructing a Family of Graphs with Maximum Proper Diameter" (2018). MAA North Central Section Fall 2018 Meeting. Southwest Minnesota State University. Marshall, Minnesota.

"Exploring Upper Bounds of Graph Proper Diameters" (2018). Northfield Undergraduate Mathematics Symposium (NUMS). Carleton College. Northfield, Minnesota.

POSTER PRESENTATIONS

"Exploring Maximum Proper Diameter of Graphs" (2019) MAA Undergraduate Poster Session, Joint Mathematics Meetings 2019. Baltimore, Maryland.

"Communication Networks and Coloring Shortest Paths"(2018). Celebration of Excellence in Science Symposium. Carleton College. Northfield, Minnesota. *(By Invitation)*

"Graphs Attaining Maximum Proper Diameter" (2018). Student Research Symposium. Carleton College. Northfield, Minnesota.

"Constructing a Family of Graphs with Maximum Proper Diameter" (2018). MAA North Central Section Fall 2018 Meeting. Southwest Minnesota State University. Marshall, Minnesota.

HONORS AND AWARDS

Nominated for membership in Sigma Xi	2020
Awarded Honors (top 15%) at Budapest Semesters in Mathematics	2019
Joint Mathematics Meetings Outstanding Poster Award	2019
Computer Science Student Hiring Committee *(By Invitation)*	*2019*
Mathematics Student Tenure-Track Hiring Committee *(By Invitation)*	*2019*
Putnam Mathematics Competition: 2 points	*2018*
National Merit Scholar (Top 1% of Candidates)	*2016-2020*

RELEVANT COURSEWORK

Computer Science:
Theory of Computing
Programming Languages: Design and Implementation
Advanced Algorithms
Computational Models of Cognition
Algorithms
Software Design
Computer Organization and Architecture
Data Structures

Mathematics:
Combinatorial Theory
Graph Theory
Quantum Probability and Quantum Computation
Game Theory
Real Analysis I
Abstract Algebra I
Mathematical Structures
Linear Algebra
Multivariable Calculus

PROGRAMMING LANGUAGES

Proficient: Python, Java, C, NetLogo, LaTeX

Familiar: JavaScript, Scheme, HTML/CSS, MIPS, PAL