Austin Ulrigg

Email: austinul@uw.edu
University of Washington
https://austinulrigg.github.io/

Goals

Pursuing a B.Sc. in Mathematics, minor in Philosophy. Intending to complete a Ph.D. in Mathematics.

Education

2023– **B.Sc. in Mathematics**, *University of Washington*, Seattle, *3.94 GPA*

2023– **Minor in Philosophy**, *University of Washington*, Seattle, *4.0 GPA*

2020–2022 **Associates in Science**, *Centralia College*, Centralia, WA

2020–2022 **Certificate of Completion in Data Analysis**, *Centralia College*, Centralia

2018–2022 **High School Diploma**, *Centralia High School*, Centralia

Research

Spring 2024 **Washington Experimental Math Lab (WXML)**, *University of Washington*, Seattle
In progress...

Spring 2024 **Genus of (3,g) Cages, Balaban's 10-cage**, *University of Washington*, Seattle
In progress...

Talks and Presentations

- **July 2024 Advanced Linear Algebra Reading Group for Undergraduates**
  Led an Undergraduate Reading Group with 25+ members on Sheldon Axler's Linear Algebra Done Right. Hosted and organized meetings, assigned problem sets, graded problem sets, and directed members to other resources. Covered topics in Chapters 3, and 5-9. Including quotient vector spaces, dual spaces, multilinear algebra, tensors, inner product spaces, etc..
- **Jun 2024 Euler Characteristic of a Torus and the Utilities Problem**
  Delivered a presentation to 30 advanced high school students on surfaces with different genus's, Euler's formula for polyhedra and planar graphs. Additionally, I explained the utilities problem, demonstrated the solution for the genus of a torus, and showed how the utilities problem could be solved on a torus.
- **March. 2024 Complex Analysis Reading Group for Undergraduates**
  Led an Undergraduate Reading Group with over 30 members on Stein & Shakarchis Complex Analysis. Hosted and organized meetings, assigned problem sets, graded problem sets, and directed members to other resources. Covered topics in Chapters 1 through 3 of Stein & Shakarchis Complex Analysis.
- **July. 2023 Advanced Calculus Reading Group for Undegraduates**
  Led an Undergraduate Reading Group with 15 members on Follands Advanced Calculus. Hosted and organized meetings, assigned problem sets, graded problem sets, and directed members to other resources. Covered topics in Chapters 1 through 3 of Folland's Advanced Calculus.

Skills

- LaTeX: 3+ years
- R/Rstudio: Used in all Certificate in Data Analysis courses
- MATLAB/Mathematica: Used in WXML Research Project
- Certificates in Excel/Word/Powerpoint

Outreach and Service

- **CLUE Mathematics Tutor, University of Washington, September 2024 -**
- **Math and Science tutor, Centralia College, May. 2020–June. 2022**
  I tutored Calculus 1-3, Intermediate Statistics, and Human Biology. I had other responsibilities in running the tutoring center at Centralia College (delegating responsibilities, directing students to campus resources, responding to queries, etc.), ensuring the tutoring center ran smoothly, forming collaborations with professors at Centralia College, and encouraging a friendly, inclusive environment for all students.
- **Summer Credit Retrieval Assitant, Centralia High School, Summer. 2017 & 2018–** Collaborated with students to complete homework assignments, identify lagging skills, and correct common misunderstandings and weaknesses.
- **Jan. 2023–** Volunteer tutor with over 100,000 posts on a large online community exceeding 200,000 members globally, which seeks to stimulate mathematical discussion and interest, as well as to provide assistance with math.
- **May.–June. 2024** Contributed around 12 pages to the solution manual for *Pearls in Graph Theory* by Nora Hartsfield and Gerhard Ringel, working alone to form 12 pages of solutions which are posted on `https://austinulrigg.github.io/posts/2024/06/Pearls-In-Graph-Theory-Solutions/`.

Honors and Awards

- 2023- **Math Alliance Predoctoral Scholar**
- 2022 -**#1 Ranked Student in Centralia High School Class of 2022**
- 2022 **Centralia College Outstanding Student of the Year Nominee**
- 2021- **Phi Theta Kappa Honor Society**
- **2023–2024** Dean's list.
  Fall 2023, Spring 2024

Mathematics Coursework

MATH394 **Probability I, Summer 2024**
Studied axiomatic definitions of probability, random variables, conditional probability, expectations, variance, and various named distributions. Explored transformations of random variables, Markov and Chebyshev's inequality, and weak law of large numbers for finite variance.

MATH395 **Probability II, Summer 2024**
Explored jointly distributed random variables, conditional distributions and densities, covariance, correlation, moment generating functions, sums of independent random variables, Central Limit Theorem, and inequalities such as Chernoff's and Jensen's.

MATH563 **Foundations of Combinatorics 3, Spring 2024**
Covered a wide array of advanced topics in Graph Theory such as maximum cut algorithms, Goemanns-Williamson, the probabilistic method, the Mycielskian, chromatic number, Havel/Hakimi theorem, Turan's theorem, notions of graph boundary/curvature, crossing number, Sidorenko's

conjecture, Rado graphs, the 5-color theorem, Moore graphs, Hamiltonian paths, cage graphs, and the Nash-Williamson formula.

MATH336 **Honors Accelerated Advanced Calculus 3, Spring 2024**

Complex Analysis: Covered a comprehensive range of topics in complex analysis, drawing from Stein & Shakarchi Chapters 1-5 and covering advanced concepts such as the Zeta function, the Prime Number Theorem, and the Riemann Sphere. Explored the theory and applications of holomorphic functions, Cauchy-Riemann equations, power series, and Goursat's theorem. Analyzed fundamental theorems including Cauchy's theorem, residues, Lionville's theorem, and the Fundamental Theorem of Algebra. Explored Morera's theorem, Schwarz reflection principle, and the symmetry principle, along with Runge's approximation theorem and meromorphic functions. Learned about Casorati-Weierstrass and Picard's theorem, the argument principle, and Rouche's theorem. Explored principles such as the open-mapping principle and Maximum/Minimum modulus principles. Studied topological concepts like homotopy and simply connected domains.

MATH403 **Modern Algebra 2, Spring 2024**

Covered foundational concepts in group theory, encompassing examples of finite and infinite groups such as symmetric and alternating groups, dihedral groups, and their properties. Analyzed subgroup structures, normal subgroups, and quotient groups, alongside the application of isomorphism theorems. Investigated finite abelian groups and advanced topics including Sylow theorems, group actions, conjugacy classes, and counting techniques.

MATH399 **Undergraduate Research, Spring 2024**

See WXML Spring 2024 in Research Section of CV.

MATH335 **Honors Accelerated Advanced Calculus 2, Winter 2023**

Explored a comprehensive range of topics in multivariable calculus, real analysis, Fourier analysis, and PDEs such as: Line integrals, rectifiable curves, Green's theorem, Surface integrals, Divergence theorem, Green's Formulae, Stoke's theorem, Poisson's equation, Gauss's Law, Maxwell's equations, Differential forms, external derivatives, Generalized Stoke's theorem, infinite series, Dirichlet's test, Riemann's theorem, Abel's theorem, uniform convergence, pointwise convergence, Weierstrass M test, power series, improper integrals, convolutions, Weierstrass approximation theorem, Fourier series, Bessel's inequality, the Wave equation, the Heat equation, and Parseval's identity.

MATH340 **Abstract Linear Algebra, Winter 2023**

Explored linear algebra from a theoretical point of view. Covered abstract vector spaces and linear transformations, bases and linear independence, matrix representations, Jordan canonical form, linear functionals, dual spaces, bilinear forms and inner product spaces.

MATH402 **Modern Algebra 1, Winter 2023**

Covered introductory theory of rings and fields: basic number theory of the integers, congruence of integers and modular arithmetic, basic examples of commutative and non-commutative rings, polynomial rings, irreducibility of polynomials, polynomial congruence rings, ideals, quotient rings, isomorphism theorems. Additional topics including Euclidean rings, principal ideal domains and unique factorization domains.

MATH334 **Honors Accelerated Advanced Calculus 1, Fall 2023**

Covered topics in introductory real analysis/topology and Euclidean spaces. Limits, continuity, completeness, monotone sequence theorem, nested interval theorem, Bolzano-Weierstrass theorem, compactness, extreme value theorem, Heine-Borel, metric spaces, connectedness, intermediate value theorem, uniform continuity, differential calculus, min/max theorem, Rolle's theorem, mean value theorem, differentiability in R^n, directional derivatives, the gradient, the

chain rule, convexity, Taylor's theorem, Lagrange's remainder theorem, the 2nd derivative test, Lagrange multipliers, the mean-value inequality, the Jacobian, integral calculus, the Riemann integral, Riemann-Darboux theorem, the fundamental theorem of calculus, Jordan measurability, Fubinis theorem, Arezela's dominated convergence theorem, improper integrals, Newton's method, and the inverse function theorem.

MATH342 **The Art of Problem Solving, Fall 2023**

Explores the artful side of problem-solving, with examples from various fields across mathematics, including combinatorics, number theory, algebra, geometry, probability, and analysis.

MATH207 **Differential Equations, Summer 2023**

Covered topics of ordinary differential equations, such as solution of First-order ODE's by Analytical, Graphical and Numerical Methods; Linear ODE's, Especially Second Order with Constant Coefficients; Undetermined Coefficients and Variation of Parameters; Sinusoidal and Exponential Signals: Oscillations, Damping, Resonance; Complex Numbers and Exponentials; Fourier Series, Periodic Solutions; Delta Functions, Convolution, and Laplace Transform Methods; Matrix and First-order Linear Systems: Eigenvalues and Eigenvectors; and Non-linear Autonomous Systems: Critical Point Analysis and Phase Plane Diagrams.

No Code **Intermediate Statistics, Summer 2020**

Expands on concepts of data collection, data cleaning, descriptive statistics, and inferential statistics. Emphasis on statistical software and applications in data science.

No Code **Statistical Programming, Summer 2020**

Introduction to data structures and implementing procedures in statistical computing languages and spreadsheet applications. Including R, Python, and Excel.