Frankie Gillis

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Education

BSc (Hons) Mathematics | University of St Andrews   Sept 2024 – May 2027
- **Sub-honours average**: 19.75/20
- Received the Tullis Medal and Prize for Pure Mathematics.
- **Grades**: Linear Mathematics (20), Combinatorics and Probability (20), Analysis (20), Vector Calculus (20), Abstract Algebra (20), Mathematical Modelling (20), Multivariate Calculus (19), Statistical Inference (19).

Research Experience

Research Intern | Laidlaw Scholar | Combinatorics   June 2025 – Aug 2025
- Completed a summer research internship in Combinatorics under the supervision of Dr Thomas Coleman in the School of Mathematics and Statistics, researching algebraic graph theory using methods from inverse semigroup theory.
- Proved a correspondence between pseudo-similar vertices in graphs and Green's relations on the graph's inverse monoid of partial automorphisms. Used this to derive a new upper bound on the size of a set of mutually pseudo-similar vertices in a graph of a given order.
- Funded through the Laidlaw Scholars Leadership and Research Programme. Produced both an academic poster and research essay, which I presented at the Laidlaw Scholars Conference at Durham University.
- Research poster was 'Highly Commended' by a commissioning editor at the publishing group Taylor and Francis Group, and shortlisted for their F1000Research publication.

Contributor | Computational Mathematics   Feb 2025 – Present
- Contributed to the development of the Digraphs package for the GAP computer algebra system, for computing with directed graphs. Part of the vertically-integrated project in computational mathematics supervised by Prof James Mitchell.
- Designed and implemented an algorithm to determine if a digraph is 2-edge transitive. Reduced the time complexity of enumerating the 2-edges from $\mathcal{O}(n^3)$ to $\mathcal{O}(n^2 + m)$ for a digraph with n vertices and m edges. Utilised the Orbit-Stabiliser theorem in computing the final step. A note on how `Is2EdgeTransitive` works in available on my github.
- Implemented the method `DigraphMinimumCutSet` to find the minimal cut of a network using the max-flow min-cut theorem from combinatorial optimisation, utilising the existing method `DigraphMaximumFlow`.

Mathematical Writings

"A Note on Is2EdgeTransitive", explanatory note and derivation of my implementation of Is2EdgeTransitive in GAP, October 2025.

"Understanding Pseudo-similarity in Graphs: a Path to Proving the Reconstruction Conjecture", research essay summarising the main findings of my summer research project, Laidlaw Scholars Network, September 2025.

Conference Presentations

"Understanding Pseudo-similarity in Graphs: a Path to Proving the Reconstruction Conjecture" (poster), Laidlaw Scholars Conference, Durham University, October 2025.