NICHOLAS C. HAYEK

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EDUCATION

McGill University
B.A. Honours Mathematics and Computer Science

Montreal, QC
08/2022 - 05/2026

- GPA: **3.788**, Dean's Honour List, D. Lorne Gales Scholarship.
- Coursework: Abstract Algebra (I-IV), Machine Learning, Algorithmic Game Theory, Propositional Proof Complexity.

WORK EXPERIENCE

Department of Mathematics & Statistics, McGill
Course Assistant

Montreal, QC (In Person)
08/2025 - present

- Review and grade homework assignments for 80 students in Honours Algebra I.

Indiana University, Indianapolis (IUI) REU Program
Biomath Modelling Research Intern

Indianapolis, IN (In Person)
06/2024 - 08/2024

- Modeled corticostriatal brain networks involved in binge alcohol drinking in rodents using a continuous-time neural network.
- Verified results from literature and analyzed model dynamics to gain insights into the biological mechanisms of addiction.
- Presented findings at the Indiana Undergraduate Math Research Conference and at the IUI Summer Research Symposium. Mentored by Prof. Alexey Kuznetsov with help from the Indiana Alcohol Research Center.

ACADEMIC PROJECTS

Course Transcription
01/2023 - present

- Publish typeset transcriptions for courses in linear algebra, probability, discrete math, ordinary differential equations, group theory, and Galois theory, among others, in LaTeX (300+ pages).
- ~150 downloads by students per month. Example [here](4).

Migraine Tracker Web App
11/2025

- Developed a [web application](5) to track migraines using Firebase, Svelte, and JavaScript.
- Allows users to make accounts, create and customize calendars, and log daily morning/night information.

McGill AI Research Lab (MAIL)
08/2025 – 10/2025

- Investigate current-event bias in news reporting by training static word2vec encodings on scraped news datasets and masking pre-trained contextual embeddings. Generate scorecards for outlets by measuring the contribution of opinionated language to target encodings (e.g. "*Vladimir Putin*").

Gale-Shapley Visualizer
10/2025

- Developed an [interactive visualizer](6) of the Gale-Shapley algorithm in JavaScript, after a learning about it in *Algorithmic Game Theory*.

Honours Research Project
05/2025 - 08/2025

- Studied supersingular elliptic curve isogeny graphs (SIGs) over finite fields and their applications to cryptography.
- Implemented SIGs and supersingular *j*-invariant finders in Python, as well as a hash function based on traversals along SIGs, which may be used to encrypt 128-bit messages. Report [here](7). Mentored by Prof. Henri Darmon.

Director of the McGill Undergraduate Mathematics Research Journal
08/2024 - 05/2025

- Oversaw the revamping of the *McGill Undergraduate Mathematics Research Journal*, which has been defunct since 2014.
- Recruited editorial and grad student peer-review team, fundraised, and assisted in curating articles, editing and layout.

Virtual Musical Instrument Development
12/2024 - 01/2025

- Developed a VST/AU virtual musical instrument based on over 350 self-recorded clips of a Steinway Model B.
- Build in C++ with 4 channels of audio. Implemented adjustable attack, decay, sustain, and release parameters and velocity-based sample selection. Users can play live or recorded music using a piano keyboard controller. Link [here](8).

Satisfiability Solver
12/2024

- Developed a satisfiability solver in the functional language OCaml to analyze solution spaces of arbitrary Boolean formulas.
- Optimized this common tool using tail recursion and memoization for stack and space efficiency.

SKILLS AND ADDITIONAL INFORMATION

Computer	Python, Java, C, C++, OCaml, Linux, Assembly, JavaScript, Svelte, Data Science (Matplotlib, Pandas, NumPy, SciPy), LaTeX
Extracurricular Activities	Vice President, External of the *Society of Undergraduate Mathematics Students* CKUT Radio Station, *The McGill Tribune*, Book Club
Languages	English (native)
Interests	Jazz piano, music production, reading

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[1] https://nicholashayek.com/

[2] https://github.com/hayekn

[3] https://www.linkedin.com/in/nicholas-hayek-b24b1a243/

[4] https://sumsmcgill.ca/wp-content/uploads/2025/10/Algebra-4-Notes.pdf

[5] https://nicholashayek.com/goodcalendar/

[6] https://nicholashayek.com/matchmaker/

[7] https://nicholashayek.com/tex/MATH/470/470report.pdf

[8] https://nicholashayek.com/proj.html