

# 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
- Coursework: Abstract Algebra (I-IV), Machine Learning, Algorithmic Game Theory, Propositional Proof Complexity.
- Honours: D. Lorne Gales Scholarship; Tomlinson Engagement Award for Mentoring; Dean's Honour List.

## 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 per month by students. Example [here](#)<sup>4</sup>.

### Migraine Tracker Web App

11/2025

- Developed a [web application](#)<sup>5</sup> to track migraines using Firebase, Svelte, and JavaScript.
- Allows users to make accounts, create and customize calendars, and submit daily logs.

### 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](#)<sup>6</sup> of the Gale-Shapley Deferred Acceptance algorithm in JavaScript, after a learning about the topic 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](#)<sup>7</sup>. 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](#)<sup>8</sup>.

### 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

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

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<sup>4</sup> <https://sumsmcgill.ca/wp-content/uploads/2025/10/Algebra-4-Notes.pdf>

<sup>5</sup> <https://nicholashayek.com/goodcalendar/>

<sup>6</sup> <https://nicholashayek.com/matchmaker/>

<sup>7</sup> <https://nicholashayek.com/tex/MATH/470/470report.pdf>

<sup>8</sup> <https://nicholashayek.com/proj.html>