

# Anatoly Zavyalov

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## Education

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### University of Toronto

September 2020 - June 2024 (expected)

H.B.Sc. MATHEMATICS, COMPUTER SCIENCE, PHYSICS  
3.98 cGPA

**Relevant Coursework:** Algorithm Design and Analysis; Data Structures and Analysis; Computational Complexity and Computability; Probability; Complex Analysis; Linear Algebra; Combinatorics; Analysis; Advanced Ordinary Differential Equations

## Honors and Awards

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### Dean's List Scholar

June 2021, June 2022, June 2023

AWARDED TO A SMALL GROUP OF THE UNIVERSITY OF TORONTO'S FACULTY OF ARTS & SCIENCE STUDENTS WHO HAVE A CUMULATIVE GPA OF 3.50 OR HIGHER AFTER COMPLETING 6 CREDITS.

### NSERC Undergraduate Student Research Award - \$7,500

March 2023

OFFERED BY PROFESSOR AZADEH FARZAN FROM THE UNIVERSITY OF TORONTO'S DEPARTMENT OF COMPUTER SCIENCE FOR THE PROJECT "COMMUTATIVITY IN PROGRAM VERIFICATION".

### Ashbaugh Chancellor's Scholarship - \$500

November 2022

AWARDED FOR HIGH ACADEMIC ACHIEVEMENT IN THE 2021-2022 ACADEMIC SESSION BY THE TRINITY COLLEGE AT THE UNIVERSITY OF TORONTO.

### University of Toronto Scholar - \$1,500 × 2

August 2021, August 2022

AWARDED FOR OUTSTANDING ACADEMIC ACHIEVEMENT IN FIRST AND SECOND YEARS OF UNDERGRADUATE STUDIES.

### NSERC Undergraduate Student Research Award (Declined the offer) - \$7,500

March 2022

OFFERED BY PROFESSOR ALLAN BORODIN FROM THE UNIVERSITY OF TORONTO'S DEPARTMENT OF COMPUTER SCIENCE FOR THE PROJECT "ONLINE AND OTHER MYOPIC ALGORITHMS". I DECLINED THE OFFER.

### Fields Undergraduate Summer Research Program (Declined the offer)

March 2022

OFFERED BY THE FIELDS INSTITUTE FOR THE PROJECT "EXTENDING TRACE THEORY FOR CONCURRENT PROGRAM ANALYSIS". I DECLINED THE OFFER.

### Elizabeth Kingstone Scholarship - \$500

November 2021

AWARDED FOR HIGH ACADEMIC ACHIEVEMENT IN THE 2020-2021 ACADEMIC SESSION BY THE TRINITY COLLEGE AT THE UNIVERSITY OF TORONTO.

### Summer Undergraduate Research Program (SURP) Fellowship - \$9,595

May 2021

AWARDED BY THE DAVID A. DUNLAP DEPARTMENT OF ASTRONOMY AND ASTROPHYSICS AT THE UNIVERSITY OF TORONTO.

### University of Toronto Excellence Award (UTEA) - \$7,500

April 2021

AWARDED TO SUPPLEMENT FUNDING FOR SURP RESEARCH.

## Publications

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- 2023 Jeffrey Shallit, **Anatoly Zavyalov**, “Transduction of Automatic Sequences and Applications”, *arXiv e-prints* arXiv:2303.15203 (27 March 2023); <https://doi.org/10.48550/arXiv.2303.15203>  
*To appear at CIAA 2023*
- 2022 Adam D. Hincks, **Anatoly Zavyalov**, and Dhananjay Bansal, “A graph database solution for tracking the deployment and layout of a large radio interferometer”, *Proc. SPIE 12189, Software and Cyberinfrastructure for Astronomy VII*, 1218909 (29 August 2022); <https://doi.org/10.1117/12.2627960>
- Devin Crichton, et al., “The Hydrogen Intensity and Real-time Analysis eXperiment: 256-Element Array Status and Overview.” *J. Astron. Telesc. Instrum. Syst.* 8 (1), 011019 (12 January 2022); <https://doi.org/10.1117/1.JATIS.8.1.011019>

## Talks

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- 2023 Canadian Undergraduate Math Conference: “Automatic Sequences”. (June 21, 2023)  
(Slides)
- UTSC CMS Undergraduate Seminar: “Automatic Sequences”. (January 19, 2023)  
(Slides) (Recording)

## Research Experience

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### UNIVERSITY OF TORONTO | RESEARCH ASSISTANT

May 2023 – Present

DEPARTMENT OF COMPUTER SCIENCE

- Researching algebraic methods for concurrent program verification, under the supervision of Professor Azadeh Farzan.
- Research is done as part of the CS Undergraduate Research Summer Program at the University of Toronto, supported by an NSERC Undergraduate Summer Research Award.

### UNIVERSITY OF WATERLOO | RESEARCH ASSISTANT

May 2022 – Present

DAVID R. CHERITON SCHOOL OF COMPUTER SCIENCE

- Researching and implementing algorithms into **Walnut**, a theorem proving software for automatic sequences written in **Java**, under the supervision of Professor Jeffrey Shallit.
- Discovered novel approaches to transducing non-morphic sequences and proved new theorems regarding running sums of the Thue-Morse sequence, resulting in a publication.

### UNIVERSITY OF TORONTO | RESEARCH FELLOW

May 2021 – April 2022

DAVID A. DUNLAP DEPARTMENT OF ASTRONOMY AND ASTROPHYSICS

- Developed **Padloper**, a full-stack graph database solution for tracking deployment and layout of a large radio interferometer, using **JanusGraph**, **Flask** and **React**, under the supervision of Professor Adam Hincks.
- Padloper is to be used for the **Hydrogen Intensity and Real-time Analysis eXperiment (HIRAX)** and at the **Simons Observatory**.

- Benchmarked ways to represent properties, connections, and changes to components in a **JanusGraph** graph database for efficient and intuitive querying.
- Research done in part during the **Summer Undergraduate Research Program (SURP)** in the DADDAA, conducted in the summer of 2021.

## Teaching Experience

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### UNIVERSITY OF TORONTO | TEACHING ASSISTANT

February 2022 – May 2022

- Teaching Assistant for **CSC240H1: Enriched Introduction to the Theory of Computation**.
- Graded assignments and tests for 90+ students, ran tutorials on automata theory and correctness of algorithms.

### UNIVERSITY OF TORONTO | SUMMER CAMP ASSISTANT

July 2021 – August 2021

MATHEMATICS OUTREACH OFFICE, DEPARTMENT OF MATHEMATICS

- Supervised online camp sessions, tracked student attendance, and solved technical problems.
- Helped students during problem-solving sessions to turn their ideas into proper solutions.

### WESTON LEARNING CENTRE | TEACHING ASSISTANT

March 2018 – August 2020

- Instructed accelerated Grade 12 Physics (SPH4U) and Grade 11 Functions (MHF3U) curricula.
- Led a course on computer fluency and introduction to programming using Scratch and Python.
- Worked with students of Grades 1 through 12 to make learning fun and straightforward.

### PRIVATE TUTOR

2016 – Present

- Working with dozens of clients over several years, solidifying students' understanding of material, exposing them to new topics, and preparing them for tests, examinations and contests.
- Teaching mathematics, physics, computer science and programming in Python and Java.

## Other Experience/Volunteering

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### SIGMACAMP | COUNSELOR

2022 – Present

- Teaching Assistant for "Surprises in Probability" semilab instructed by Professor Sofya Raskhodnikova; prepared hands-on activities involving counterintuitive topics in probability.
- Gave lectures on breadth-first search, depth first search, and Python basics.
- Authored problems for math, CS, physics, and linguistics for Problem of the Month.
- Judged academic tournaments for CS, engineering, linguistics, chemistry, and biology.

### COMPUTER CLUB | EXECUTIVE

2018 – 2020

THORNHILL SECONDARY SCHOOL

- Organized and led weekly lessons to teach the Java and Python programming languages, as well as tackle challenging problems with the help of programming.
- Created interactive lessons using the Pygame graphics library and the Python programming language.
- Contributed to development of the TSS Competitive Programming Online Judge (tssoj.ca), authored programming questions for the platform.

## Projects

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### **SUPREM.IO**

REACT, JAVASCRIPT, HTML, CSS, PIXIJS, NODE.JS, COLYSEUS

An online multiplayer battle arena platformer game with tons of weapons and enthralling, high-pace gameplay.

- SUPREM.IO achieved more than 178,000 page views in March 2023.
- Created and fostered a community of 650+ players around the game.
- Singlehandedly created and developed the game, including all game assets and graphics, gameplay, game logic and server-side infrastructure.
- Used the **PixiJS** rendering library for rendering the game, and used **React, JavaScript, HTML** and **CSS** for the front-end interface.
- Used **NodeJS**, **Colyseus**, and **Nginx** for the backend.

### **VESSEL CLASH**

C++, SFML

A space-themed endless arcade shooter with thrilling powerups, unique enemies, and epic bosses.

### **OGYGIUS**

C++, SFML

A top-down Minecraft-esque survival game, with crafting, animals, building, and procedurally generating biomes.

## Skills

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- **Languages:** English (fluent), Russian (fluent), German (elementary)
- **Programming Languages:** C++, Java, Python, JavaScript, TypeScript
- **Web:** React, HTML, CSS
- **Backend:** PostgreSQL, Flask, JanusGraph, Gremlin, Apache TinkerPop, Colyseus
- **Other:** NumPy, Pandas, PixiJS, SFML,  $\text{\LaTeX}$ , Git

## Professional Development

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### **Linear Regression with NumPy and Python (Coursera)**

AUGUST 2022

### **Database Design and Basic SQL in PostgreSQL (Coursera)**

JUNE 2022