

# Isaac Holt

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## Summary

Highly capable mathematician, with a final year average grade of 97% at undergraduate (the highest in my year), who excels at tackling difficult and technical problems. Strong skills in a variety of programming languages and owner of a popular Rust library with over 500,000 downloads. Experience in mathematical research, soon-to-be co-author of a paper on tropical geometry. Focussed and driven, with a passion for setting challenging goals and achieving them.

## Education

**Durham University**, BSc Mathematics 09/2021 – 06/2024

- Classification: First Class Honours.
- Grade: 95% (joint-highest in my cohort).
- Awards: The Mathematical Sciences Best 3H Student Prize

**University of Cambridge**, MAST in Mathematics 10/2024 – 06/2024

**Colchester Royal Grammar School** 09/2019 – 06/2021

- A Levels: Mathematics (A\*), Further Mathematics (A\*), Physics (A\*), Latin (A\*).
- Awards: Year 13 Prize for Further Mathematics.

## Research Experience

**Research Project in Tropical Geometry** 06/2023 – 07/2023

Department of Mathematical Sciences, Durham University

- Area of research was how the tropical modification of certain polynomial systems can be used to determine the generic root count of those systems.
- The results of our work are expected to be published in a paper by the end of this year.
- Invited by supervisor to attend a [working\\_group](#) for the OSCAR computer algebra system in Germany, to write code related to the project.

## Work Experience

**Web and Communications Internship** 07/2023 – 08/2023

Grey College, Durham University

- Created a [new website](#) for Grey College Senior Common Room, using React, Next.js, Bootstrap, and KV storage.
- Built an admin dashboard with an email client for sending markdown emails and templated emails.
- Developed a password-less email authentication system.

**Student Digital Leader** 09/2022 – 06/2023

Durham University

- Part of a pool of students who worked on various technical projects for the university.
- For the first few weeks, I worked in online support with the university's digital services for new students.
- I then worked as a UAT (User Acceptance Testing) Analyst within this role, using Azure DevOps and Jira to pass/fail test cases and report bugs for a new event-booking website that the university is launching.

**Software Tester** 01/2021 – 03/2021

Blutick

- Tested Blutick's marking software for online GCSE maths exams, reported bugs I found when using the website.
- Given the responsibility of editing the online questions and mark schemes myself using Latex.
- Developed TypeScript program to generate all solutions for questions where many combinations of answers were allowed.

## Projects

**bnum** 05/2021 – Present

Mathematical [Rust library](#) with over 500,000 downloads that uniquely provides fixed size signed and unsigned integer types, designed to extend functionality of Rust's primitive integer types to arbitrary bit sizes. Used by a blockchain-related package.

## Extracurriculars

Piano (ABRSM Grade 8 Distinction) | Durham University Chess Society | Durham University Spaceflight Society | Durham University Mathematical Problem Solving Society | Grey College Table Tennis A Team | Grey College Badminton B Team | Durham University Chess Society | Durham University Quant Fund | Co-leader of Physics and Maths Society at Sixth Form

## Skills



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## Summary

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Highly capable third year undergraduate mathematician with current average mark of 91%. Seeking admission into the MAST in Mathematics, with wide-ranging interests in areas such as number theory, combinatorics and quantum computation. Driven and committed to expanding and deepening my mathematical knowledge and discovering new results, as the co-author of a paper on tropical geometry which has been submitted as a chapter for a forthcoming book.

## Education

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**Durham University**, MMath Mathematics 09/2021 – Present

- Third year modules: *Analysis, Cryptography and Codes, Galois Theory, Number Theory, Quantum Computing, Topology*.
- Grade: 1st (expected). First year average: 90%, second year average: 92%.
- Notable marks (1st year): *Discrete Mathematics*: 90% | *Analysis*: 91% | *Linear Algebra*: 96%.
- Notable marks (2nd year): *Algebra*: 94% | *Complex Analysis*: 95% | *Elementary Number Theory*: 98%.

**Colchester Royal Grammar School** 09/2019 – 06/2021

- A-levels: Mathematics (A\*, 99%), Further Mathematics (A\*, 97%), Physics (A\*, 91%), Latin (A\*, 90%).
- Awards: Year 13 Prize for Further Mathematics - I was selected for this prize out of the 50 or so students in my cohort taking Further Mathematics A-level.

## Research Experience

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**Summer Research Project** - Department of Mathematical Sciences, Durham University 06/2023 – 07/2023

- Area of research was in tropical geometry; specifically, how the modification and tropicalisation of horizontally parametrised polynomial systems can be used to determine the generic root count of those systems.
- First four weeks were mostly spent learning about the area and reading relevant books and materials.
- Last four weeks were devoted to formulating and proving a new result, where I produced a generalised proof of a theorem from a recent paper on the number of equilibria of coupled nonlinear oscillators.
- Paper has been published on [arXiv](https://arxiv.org/abs/2311.18018) and submitted as a chapter for the upcoming book on the OSCAR computer algebra system.
- Invited by my supervisor to attend a [working group](#) for OSCAR at Paderborn University, Germany, to write an illustrative [program](#) in Julia for the paper.

**(Upcoming) Mitacs Globalink Research Internship** - University of British Columbia 06/2024 – 08/2024

## Work Experience

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**Web and Communications Internship** - Grey College, Durham University 07/2023 – 08/2023

- Developed the [new website](#) for my college's Senior Common Room, using my programming abilities.

**Student Digital Leader** - Durham University 09/2022 – 06/2023

- Worked as a User Acceptance Testing Analyst, using Azure DevOps to pass/fail test cases and report bugs for a new event-booking website that the university is launching.

**Software Tester** - Blutick 01/2021 – 03/2021

- Used my capacity for mathematical rigour to test the marking software for online GCSE maths exams.
- Having excelled in this task, was given the responsibility of editing the questions using LaTeX.
- Developed computer program to generate all solutions for questions where many combinations of answers were allowed.

## Publications

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Holt, I., & Ren, Y. (2023). *Generic root counts of tropically transverse systems – An invitation to tropical geometry in OSCAR*. Available at [arXiv:2311.18018](https://arxiv.org/abs/2311.18018).

## Projects

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**bnum** 05/2021 – Present

- Mathematical [Rust library](#) for operating on arbitrarily-sized integers, with over 250,000 downloads.
- Is a dependency for two other libraries, including a popular smart contract [package](#).
- To my knowledge, it is the only library to extend functionality of Rust's primitive integer types to arbitrary, fixed size signed and unsigned integers.
- Development involved researching arithmetical algorithms, e.g. Knuth's integer division algorithm and exponentiation by squaring.

## Relevant skills

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- Mathematical research experience, including helping produce a paper in 2023 on tropical geometry.
- Experience reading mathematical publications (currently reading *Mathematical Logic* by Cori and Lascar).
- Experience in the typesetting languages Latex and Typst - typeset notes for my undergraduate modules are available on my [website](#).
- Programming experience in a variety of languages: Rust, Python, Julia, R, JavaScript, TypeScript.

## Extracurriculars

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- Co-leader of Physics and Maths Society at Sixth Form
- Durham University Mathematical Problem Solving Society
- Simon Marais Mathematics Competition (2022, 2023)
- Imperial-Cambridge Mathematics Competition (2022, 2023)
- British Mathematical Olympiad (2020)
- Classical Piano (ABRSM Grade 8 Distinction, working towards the ARSM diploma)
- Durham University Chess Society
- Durham University Spaceflight Society
- Grey College Badminton B Team
- Grey College Table Tennis A Team
- Durham University Table Tennis Development Squad