Zac Garby

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Education

2019-present **University of Nottingham**
MSci Computer Science, four year course.

Year 4: In progress (predicted first)

Research Project (in progress)

"Fantasia: Synthesising Recursive Functions Without Trace-complete Examples." Building on top of *Fugue* from my earlier dissertation, I devised novel techniques for synthesis of recursive functions requiring less input-output examples than similar existing methods, using thunks and auxiliary functions.

With this, I looked into in the interactive applications of program synthesis, and how best the experience can be made as friendly and as useful as possible.

Music & Mixed Reality (88%)
Advanced Algorithms & Data Structures (89%)
Games (in progress)
Fuzzy Logic (in progress)

Year 3: First (89%, highest grade in my year**)**

Dissertation (89% – awarded the year's Best Dissertation Prize)

"Fugue, a Friendly Functional Programming Language with Holes." I designed and implemented a functional programming language, named Fugue, with a novel type system based on Hindley-Milner. The language compiles to an enhanced lambda calculus and supports interactive programming to an extent using holes, and I devised a heuristic for suggesting and prioritising possible hole fills.

Compilers (96%)
Programs, Proofs & Types (97%)
Knowledge Representation & Reasoning (91%)
Others: (72%, 93%, 78%)

Year 2: First (87%)

Software Engineering Group Project (*89%*)

"Surreal Numbers and Games." Using Haskell, we explored the usage of John Conway's surreal number system for general game-playing AI to produce a program that could perform well against human players even on games it had never seen. Specifically, it worked with 2-player perfect information games, and included a Haskell API for users to define their own games.

Algorithms, Correctness & Efficiency (*92%*)
Operating Systems & Concurrency (*89%*)
Advanced Functional Programming (*87%*)
Others (*89%, 86%, 81%, 80%*)

Year 1: First (91%)

Mathematics for Computer Scientists (*97%*)
Programming & Algorithms (*96%*)
Databases & Interfaces (*93%*)
Others (*90%, 90%, 88%, 81%, 88%*)

2015-2019 **The Thomas Hardye School, Dorchester**
A-Levels

Mathematics: *A**; Further Mathematics, Computer Science, and Physics: *AAA*

Experience

2022-present *HackSoc Nottingham,* President

- I am responsible for the society, including the community itself and its reputation, but also organisation and planning. I give talks and workshops, and have retained my Graphics Officer duties.

2021-2023 *HackSoc Nottingham,* Lead organiser, HackNotts

- I am responsible for the general planning and logistics of the event, as well as communicating with various companies to arrange funding and grants.
- HackNotts 23 was the largest HackNotts ever, with 204 attendees in total.

2021-2022 *HackSoc Nottingham,* Development Secretary and Graphics Officer.

- I give a number of workshops and talks on tech-related topics each month.
- I maintain the society's website and graphics.

2020-2021 *University of Nottingham,* A Computer Science mentor.

- I was assigned to a small group of first-year students to help them settle in to University.
- I ran a number of sessions with my group to help them with their first-year modules.

2018 *National Citizen Service*, Participant.

- As part of a team, raised money and restored a youth centre in Dorchester.

2017-2019 *Thomas Hardye School,* Ran the Programming & Robotics club.

- Taught a group of year 9 and GCSE students about programming, mainly through the context of robotics.

2017-2019 *Thomas Hardye School,* Volunteered at a number of STEM days.

- Ran half-day sessions teaching middle school students about programming and simple robotics using LEGO Mindstorm.

Skills & Interests

- Extensive experience in Haskell (>6 years), Python (>10 years), C, Go, JavaScript, Agda, and LaTeX. Also Rust, Java, various LISPs, and numerous domains specific languages.
- Strong interest in many areas related to programming language theory, including type theory, compiler design/implementation, and interactivity in programming languages.
- Varied experience with many areas of programming and computer science, including multimedia (image processing, audio processing/synthesis, game development), systems programming, scientific computing, full-stack web development, networking, and the design and implementation of programming language compilers.
- Strong interest in hackathons, both as an attendee and as an organiser.
- Interested in mathematics, especially where it overlaps with Computer Science.
- I enjoy playing, listening to, and creating music; I play the guitar and the piano, but I am really interested in early music and am currently building a lute. I also enjoy reading, climbing, and I am a member of—and a Training Officer at—the University of Nottingham's Medieval Combat Society.
- I have an Emergency First Aid at Work qualification.

Awards & Achievements

2023 *SussexHack 23,* Second place for my project, "Knuckles", a biomechanical robot hand.

2022 *OxfordHack 22,* Won the *What the Hack?!* prize for my project, "MusicBoard".

2022 *Computer Science, University of Nottingham,* Best Individual Year Three Dissertation prize.

2022 *Computer Science, University of Nottingham,* High Achiever's Award (top 5% in my year.)

2021 *AstonHack 2021,* First place for my project, "Network over Rube Goldberg Machine".

2021 *Computer Science, University of Nottingham,* High Achiever's Award (top 5% in my year.)

2020 *HackNotts 2020,* Sponsored prize for my project, "The Haskelltron 2000".

2020 *Computer Science, University of Nottingham,* High Achiever's Award (top 5% in my year.)

2019 *Computer Science, University of Nottingham,* Silver Scholarship (a 25% tuition fee rebate each of my four years at University, so long as I achieve 80% in each.)

2019 *Thomas Hardye School,* Selected by my school to create an interactive exhibit for the local community's "50th Anniversary of the Moon Landing" event.

2019 *Thomas Hardye School,* Received my school's first ever Computer Science subject award.

2018 *United Kingdom Mathematics Trust,* Silver award in the Senior Mathematical Challenge.

2015 *Bournemouth University,* Second place out of hundreds of entries in a programming competition.

References

Available upon request.