

Rahil Baber

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Education

- Jan 2007 – Mar 2011 **PhD** in mathematics (extremal and probabilistic combinatorics). *University College London*.
- Sept 2005 – Oct 2006 **MSc (by research)** in computer science. *Warwick University*.
- Oct 2004 – June 2005 **Certificate of Advanced Study in Mathematics**, Part III of the Tripos. *Trinity College, Cambridge*.
- Oct 2001 – June 2004 **BA(Hons) First Class**, and **MA**, in mathematics. *Trinity College, Cambridge*.
- Sept 1999 – July 2001 **5 A-levels**: Chemistry, Design and Technology, Mathematics, Further Mathematics, and Physics, **all grade A**.

Employment History

June 2022 – May 2023 **Software Engineer**. *Optiver*.

Member of the Automated Trading Systems team. Responsible for high performance apps, written in C, connecting directly to a variety of financial exchanges. Projects I worked on include: upgrading the messaging architecture between the front and back end systems, migrating system health monitoring tests to use cloud services, writing a translation module for an exchange's protocol and integrating that module in a variety of next-gen versions of the trading apps, enhancing tests to utilise timestamps on network packets, extending the packet capture utility library to allow writing data directly to the cloud.

Apr 2021 – June 2022 **Engineering Manager**. *Carallon, Brompton Technology*.

Working on software used to control LED walls for live events, and green screen replacements in filming. Managed a team responsible for delivering new features. Identified and provided alternatives to systemic design issues in a legacy code base that resulted in fixes for complex long standing critical bugs. Part of the team introducing unit testing to the company. Mentored a group of junior developers. Held weekly lectures on modern C++ (C++11 up to C++20), best practices, design patterns, and software architecture. Interviewer for new C++ developers.

Dec 2016 – Mar 2021 **Software Engineer**. *Garrison Technology*.

Developing software to allow users to securely and easily browse the web using Garrison's custom hardware servers. In charge of video encoding and decoding an H.264 video stream, encrypting and decrypting it in real time using OpenSSL primitives, and a custom UDP protocol that tries to balance between network usage, video quality, and user interaction latency. I was the team lead and architected the user facing client application for Android phones, which was then ported to iOS, macOS, and due to its successful design it ultimately replaced the existing application for Windows and Linux as well.

Sept 2015 – Nov 2016 **HPC Acceleration Architect**. *Maxeler Technologies*.

Working as part of the Data Analytics team, primarily on a C++ project to calculate in real time the risk and P&L associated with all accounts for one of the world's biggest commodity exchanges. Designed and implemented an automatic fall-over system for the project. Additionally I also created bitstreams for FPGAs using the company's custom high level language (maxJ).

Aug 2014 – June 2015 **Senior Researcher**. *Cambridge Quantum Computing*.

Head of a team of researchers and programmers, developing algorithms that can efficiently exploit the emerging technology of quantum computers, particularly in the field of finance. I gave numerous presentations to high profile investors to secure a large amount of funding for the business.

May 2012 – Sept 2012 **Post Doctoral Research Assistant**. *Queen Mary University of London*.

The position involved working with other academics to research network coding and guessing games. I developed code to analyse networks 1000 times faster than the preexisting software, which allowed me to disprove several conjectures in the area.

Additional Skills

I am primarily a C++ programmer, other languages I have programmed in include **C**, **Java**, **VBA**, **R**, **Python**, **Javascript**, **Objective-C**, and **Swift**. Software projects I have worked on include the following:

- A user friendly multithreaded program that calculates properties of hypergraphs.
- A codec that converts frames of a video into ASCII-art in real-time.
- Simulating the physics of rigid bodies colliding.
- An iPhone application for a Spanish television company.
- RSDP a cross-platform multithreaded multiprecision semidefinite program solver (a generalization of linear programming).

Awards

- Oct 2004 **Heilbronn Prize**, for outstanding academic performance.
Walker Prize.
Senior Scholarship, for examination results.
- Oct 2002 **Junior Scholarship**, for examination results.

Publications

- R. Baber, N. Behague, A. Calbet, D. Ellis, J. Erde, R. Gray, M.-R. Ivan, B. Janzer, R. Johnson, L. Milićević, J. Talbot, T. S. Tan, and B. Wickes, *A collection of open problems in celebration of Imre Leader's 60th birthday*, arXiv:2310.18163 [math.CO], (2023).
- R. Baber, and J. Talbot, *A solution to the 2/3 conjecture*, SIAM Journal on Discrete Mathematics, 28 (2), 756 – 766, (2014).
- R. Baber, D. Christofides, A. N. Dang, S. Riis, and E. R. Vaughan, *Multiple unicasts, graph guessing games, and non-Shannon inequalities*, Conference paper at The International Symposium on Network Coding (2013).
- R. Baber, *Turán densities of hypercubes*, arXiv:1201.3587v2 [math.CO], (2012).
- R. Baber, and J. Talbot, *New Turán densities for 3-graphs*, The Electronic Journal of Combinatorics, 19 (2), P22, (2012).
- R. Baber, and J. Talbot, *Hypergraphs do jump*, Combinatorics, Probability and Computing, 20, 161 – 171, (2011).
- R. Baber, J. R. Johnson, and J. Talbot, *The minimal density of triangles in tripartite graphs*, LMS Journal of Computation and Mathematics, 13, 388 – 413, (2010).