

BARINDER SINGH BANWAIT

@ barinder.s.banwait@gmail.com
github.com/barinderbanwait

members.vistaserv.net/barinder

linkedin.com/in/barinderbanwait

EMPLOYMENT

Quantitative Researcher

Quantile

📅 Sep 2019 – Mar 2020

📍 London, UK

- Linear, mixed-integer, and multi-objective optimisation for compression of interest-rate derivative portfolios using Gurobi.
- Modelling of reset risk and PV01 for swaptions.
- Analysis of trading data and software development in Python and AMPL.

Research Engineer

CMR Surgical

📅 Jan 2018 – Sep 2019

📍 Cambridge, UK

Transforming Surgery. Developing the next-generation robotic surgical system.

- Research and optimisation of robotic control algorithms, including inverse kinematics and mass-spring-damper models.
- Mathematical modelling in Matlab, with Robotics and Control Systems toolboxes.
- Writing production-level, safety-critical embedded C code, compliant with MISRA C and International Standard IEC 62304.
- Implementing machine learning algorithms for robot arm condition monitoring, using scikit-learn and Tensorflow.
- Agile software development with SVN and Git.

Postdoctoral researcher in Mathematics

Universität Duisburg-Essen

📅 Jan 2015 – Jan 2017

📍 Essen, Germany

Working in group *Algebraische Geometrie und Zahlentheorie*. Mentor: Prof. Dr. Ulrich Görtz.

Postdoctoral researcher in Cryptography

Institut national de recherche en informatique et en automatique (INRIA)

📅 Jan – Dec 2014

📍 Bordeaux, France

Working in group *Théorie algorithmique des nombres rapide et flexible*. Mentor: Dr. Andreas Enge.

PAPERS AND PREPRINTS

- Examples of abelian surfaces failing the local-global principle for isogenies. *arXiv:2007.13583*. 2020.
- Del Pezzo surfaces over finite fields and their Frobenius traces, with F. Fité and D. Loughran. *Mathematical Proceedings of the Cambridge Philosophical Society*. 167(1) (2019) 35-60.
- Tetrahedral Elliptic Curves and the local-global principle for isogenies, with J. Cremona. *Algebra and Number Theory*. 8:5 (2014) 1201-1229.

EDUCATION

PhD Mathematics

University of Warwick

📅 Jan 2010 – Sep 2013

📍 Coventry, UK

Supervisor: Prof. John Cremona.

Thesis: On some local-to-global phenomena for abelian varieties.

BA and MMath Mathematics

University of Cambridge

📅 Oct 2005 – June 2009

📍 Cambridge, UK

MMath (*Part III of the Mathematical Tripos*) - Distinction

Part III Essay: Class Field Theory (Cohomological Approach), supervised by Dr. Tim Dokchitser

INVITED TALKS

(selected)

- *Tetrahedral Elliptic Curves and the local-to-global principle for isogenies*, Indian Institute of Science Education and Research, Pune, Jan 2020
- *Traces of Frobenius and an inverse Galois Problem for cubic surfaces over finite fields*, Explicit Methods in Number Theory; Conference in honour of John Cremona's 60th Birthday, Warwick, Apr 2016
- *Courbes elliptiques tétraédriques et le principe local-global pour les isogénies*, Clermont-Ferrand Number Theory Seminar, June 2014
- *On some local-global phenomena for abelian varieties*, Indian Statistical Institute, Delhi, Oct 2013

INDEPENDENT CODING PROJECTS

 available on my GitHub

Integrally Closedness - Lean

 2020

- Formalisation of absolute and relative definitions of an integrally closed integral domain.
- Proving equivalence of definitions (work in progress):

```
lemma equiv_int_closed_abs_rel (R : Type u) (A : Type v) [integral_domain R] [comm_ring A] [algebra R A]
  (φ : fraction_map R A): is_integrally_closed R ↔ is_integrally_closed_in R A
```

Human Activity Classifier - Tensorflow

 2019

- Training a deep neural network to classify human activity from sensor data recorded by a Samsung Galaxy SII.
- 6 categories - walking, walking upstairs, walking downstairs, sitting, standing, lying.
- 92% accuracy with model consisting of 3 densely-connected neural layers and 5 epochs of training.

Elliptic Curve Diffie-Hellman Protocol - Sage

 2017

- Simple implementation of public-key cryptosystem developed by Diffie and Hellman.
- Encryption involves randomly chosen element from a finite extension of base field.

RESEARCH SEMINAR TALKS

(selected)

- *Harder-Narasimhan truncations in Vincent Lafforgue's proof of the Global Langlands correspondence*, Langlands Parameterisation over Function Fields, Essen, December 2016. Organiser: Prof. Dr. Jochen Heinloth
- *Formal Group Laws and Formal A-Modules*, The Lubin-Tate Tower and its p -adic cohomology, Essen, October 2015. Organiser: Prof. Dr. Ulrich Görtz
- *The Theorems of Bhargava-Shankar*, Ranks of Elliptic Curves, Essen, May 2015. Organiser: Prof. Dr. Massimo Bertolini

TEACHING EXPERIENCE

Course Lecturer

Vertiefung Zahlentheorie

 Apr - July 2016

 Essen, Germany

Representability of primes via quadratic forms - from Fermat, Euler, Gauss, and to Artin Reciprocity. Contact time comprised three hours per week, for 15 weeks. Lectures given in German.

Einführung in das Computer-Algebra-Paket Sage

 Sep 2015

 Essen, Germany

Introductory week-long short-course on *Sage*, aimed at final year undergraduates. First half of week devoted to overview of main features of *Sage*, the second half to programming, and to implementing their very own RSA cryptosystem. Course given in German.

Algebraic Number Theory

 July 2009

 Linyi, China

Introductory course at summer-school aimed at second year undergraduates. Topics included: Rings of integers, failure of unique factorisation in some Dedekind rings, class number computations, applications to solving Pell equations.

Seminar Organiser

Algebraic Surfaces

📅 Oct 2015 - Jan 2016

📍 Essen, Germany

Masters level seminar, organised with Prof. Görtz. We lectured on the foundations: Sheaf cohomology, Serre duality, and intersection theory. Students chose more advanced, specialist topics to give a 90-minute talk on, and obtained credits subject to delivering a satisfactory talk.

Teaching Assistant

A teaching assistant marks the student assignments, and organises a support class to discuss the questions and other problems.

Linear Algebra	📅 Apr - July 2015	🎓 Vytautas Paškūnas	🏛️ Universität Duisburg-Essen
Modular Forms	📅 Oct - Dec 2012	🎓 Mehmet Haluk Şengün	🏛️ University of Warwick
Algebraic Number Theory	📅 Jan - Mar 2012	🎓 Johan Bosman	🏛️ University of Warwick
Elliptic Curves	📅 Oct - Dec 2011	🎓 Lassina Dembélé	🏛️ University of Warwick
Algebraic Number Theory	📅 Jan - Mar 2010	🎓 William Hart	🏛️ University of Warwick

Undergraduate Supervisor

📅 Oct 2010 - Apr 2013

🏛️ University of Warwick

A supervisor is assigned groups of 5 students. The supervisor marks the assignments of his/her students, meets the students twice a week for one hour each, and discusses the assignments and other material on the courses which the students are studying, across both pure and applied disciplines.

STEP Mentor

📅 Apr 2007 - 2009

🏛️ University of Cambridge

A STEP mentor is assigned a group of 10 A-level students holding a prospective offer to study Mathematics at Cambridge University, whose own schools cannot help them with preparation. The mentor's role is to prepare the students for the STEP entrance examination, by organising classes and lessons on the STEP questions, and generally helping the students mathematically. This takes place during a week in April each year. I was a STEP mentor in 2007, 2008 and 2009.

AWARDS

Engineering and Physical Sciences Research Council, UK

📅 Jan 2010

- Full funding for PhD studies.
-

Institute for Advanced Study, Princeton NJ, USA

📅 Jul 2008

- Full funding to attend Park City Mathematics Institute conference on Algebraic Geometry in 2008.
-

Whelan Prize

📅 Oct 2007

- Awarded by Christ's College, University of Cambridge, for outstanding examination performance (top of college in mathematics).
-

Nuffield Trust, UK

📅 Jul 2007

- Undergraduate Research Bursary to conduct a summer research project.
- Supervisor: Dr. Jon Bevan, University of Surrey, UK.

REFeree DUTIES FOR JOURNALS

- Mathematics of Computation
- International Journal of Number Theory
- Algebra and Number Theory

LANGUAGES

English	<div><div></div><div></div><div></div><div></div><div></div><div></div></div>	Python	<div><div></div><div></div><div></div><div></div><div></div><div></div></div>
ਪੰਜਾਬੀ	<div><div></div><div></div><div></div><div></div><div></div><div></div></div>	Sage	<div><div></div><div></div><div></div><div></div><div></div><div></div></div>
Deutsch	<div><div></div><div></div><div></div><div></div><div></div><div></div></div>	C	<div><div></div><div></div><div></div><div></div><div></div><div></div></div>
हिंदी	<div><div></div><div></div><div></div><div></div><div></div><div></div></div>	Matlab	<div><div></div><div></div><div></div><div></div><div></div><div></div></div>
Français	<div><div></div><div></div><div></div><div></div><div></div><div></div></div>	Magma	<div><div></div><div></div><div></div><div></div><div></div><div></div></div>
Lean	<div><div></div><div></div><div></div><div></div><div></div><div></div></div>	C++	<div><div></div><div></div><div></div><div></div><div></div><div></div></div>