






# Miroslav Marinov


Mathematician





Bulgaria





## About me

I am an ambitious individual with passion for analytical problems and teamwork – in theoretical research, industrial applications, teaching. An optimal way to fully understand a concept is by communicating it to colleagues or students. This has contributed for who I am today and I am very thankful to all my collaborators with whom we have benefited from each other.

## Skills

Mathematics

Teaching

Leadership, Teamwork, Collaboration

Research & Problem Solving

Communication & Presentation Skills

Programming – Python, Mathematica

## Languages

Bulgarian – Native  
English – Fluent (Level C1)  
Russian – Novice

## Interests

Number Theory, Combinatorics, Probability, Algorithms, Discrete Fourier Analysis, Computational Mathematics, Mathematical Modelling, Olympic and Research Training, and their applications in Games, Networks

## University Education

- 2022-Present Doctorate in Mathematics Education  
Institute of Mathematics and Informatics, Bulgarian Academy of Sciences  
Main study: Education for High School students in research context.
- 2016-2020 MSc in Mathematics and Foundations of Computer Science  
St Catherine's College, University of Oxford – Graduated with First Class  
Public Examinations: MSc – 86%; BSc Part B – 78%, Rank: 17/151;  
BSc Part A – 78%, Rank: 16/193; BSc Prelims – 80%, Rank: 20/201

## Work Experience

- Oct 2020 – April 2024 Work in Industry
  - Worked on a Predictive Maintenance algorithm for an Electronic Braking Performance Monitoring System of trucks.
  - Generalized some Linear Programming problems with the aim for clients to have more evidence that a min-cost-flow algorithm indeed gives an optimal solution.
  - Performed an analysis for detecting cycles of trips (between locations) which have a sufficiently large frequency and whose timedeltas exhibit useful patterns.
  - Aided colleagues who work on forecasting by solving challenging probabilistic problems.
- PROMYS Europe Counsellor ('17-'20), Guest Alumni ('22, '23), Admissions Staff ('23, '24)  
Ross Mathematics Counsellor ('21), Admissions Staff ('23)  
Unable to attend Ross in 2022 (visa issues) and in 2023 (cancellation of the Asia program)  
PROMYS Europe and Ross Mathematics are six week programs aiming to train habits of high school students in real scientific research situations – designing numerical experiments, formulating own questions, testing conjectures, justifying ideas. A counsellor at PROMYS marks students' solutions to problem sets and has discussions with them, supervises a project, participates in seminars, gives talks on various topics and organizes extracurricular activities. (In 2022 I was for 2 weeks at PROMYS, in 2023 for 1 week, in counsellor-only activities – aid on a student research project and in the seminar.) Ross also emphasises on Number Theory, with problem sets but with the topics covered in greater depth; it also has talks and extracurriculars. This experience was beneficial to me for making new contacts, improving my organizational, time-management and team supervising skills, as well as the ability to gain and give experience on how to approach a completely new problem.
- Oct 2019 - Jan 2020 Teaching Assistant, Grader of MAT Admissions Test  
University of Oxford, Mathematical Institute and Department of Statistics  
Evaluating students' written work, discussing problem sheets and tricky examples.
- Awards and Invitations
- American Mathematical Society, MuAlphaTheta – awards for supervision of a distinguished student project at Regeneron ISEF 2023
- Bulgarian Council of Ministers – Award for activities in Mathematics Education, 2022, 2023.
- Presidency of Republic of Bulgaria – Award for activities in Mathematics Education, 2023.
- Michael Atiyah, John Maitland Wright – Mathematical Prizes – for best performance by a second year and third year Mathematics undergraduate at St Catherine's, 2018 and 2019.
- Foundations College Scholarship – an award for Master students who have first-classed their Bachelor's degree and continue studying at St Catherine's College, Oxford, 2019.
- Forbes 30 under 30 Bulgaria – Award in Science, Technology and Education, Dec 2022.
- Huawei SFTF 2022 Scholarship Program – Award for supporting Doctoral Studies, Dec 2022.
- Heidelberg Laureate Forum – participated as a Young Researcher, September 2019.
- SPLogIC 2023 – two-week summer school in Logic, Campinas, Brazil, Feb 2023.
- First prizes – International Mathematics Competition for University Students, 2021; Mirror of Putnam Competition, 2016, 2018; National Spring Maths Competition, 2016; National Undergraduate Maths Olympiad, 2016; Harvard-MIT Maths Tournament, Feb 2015 (Team).
- Oxford Alan Tayler Fund Award – support the participation at ITYM '18, '19 and MBL '20.
- Mathscon Maplesoft Grant Award – Award to support studies to an undergraduate involved in outreach activities in Mathematics, Feb 2019.



## Academic Publications and Projects

Papers are available upon request, though some of them are written only in Bulgarian language.

- *Biases among Single Primes, Products of Two Primes and Pairs of Consecutive Primes* – Master Thesis, supervised by Prof. James Maynard, Oxford Mathematics 2020.

A continuation of the work on products of two primes is *On the complete presence of a modulo 4 bias for the semiprimes*, with Nikola Gyulev, selected for Regeneron ISEF in May 2023, with Second Prize from the American Mathematical Society and First Prize from MuAlphaTheta. A joint talk at Mathematics Days in Sofia, July 10<sup>th</sup> 2023.

- *From Acute Sets to Equiangular Lines (Pointsets in  $\mathbb{R}^d$  with Angles Bounded from above by a Fixed Quantity; and of Sets of Lines with Angles of equal size)* – Bachelor Thesis, supervised by Prof. David Conlon, Oxford Mathematics 2019; see Exponentially sized pointsets with angles less than 61 degrees, arXiv:2110.02415. Talk at the Rutgers CROPS seminar, March 17<sup>th</sup> 2023.
- (Supervision) *Lower Bounds on  $\alpha$ -Numbers of Artin-Schreier Curves* – H. Berg, V. Fukala, T. Muller, P. Narkiewicz, PROMYS Europe 2019, joint work with collaborators from PROMYS Boston, *Involve*, Vol. 15 (2022), No. 4, 559-590; arXiv:2003.09028v2.
- *On Banzhaf and Shapley-Shubik Fixed Points and Divisor Voting Systems* – PROMYS 2020, arXiv:2010.08672, see also [~zeilberg/EM22/projs.html](https://zeilberg.EM22/projs.html).

*Fixed systems of the Shapley-Shubik and Banzhaf indices with one or two presidents* – D. Nedeva, awards at International Conference of Young Scientists 2022, Bulgaria Innofair 2023, HSSIMI 2021-2023, Euromath 2022.

*Point-Hyperplane Incidence Matrix around the Finite Field Kakeya Conjecture* – D. Nedeva, award at Luxembourg International Science Fair 2023, work has started at PROMYS Europe 2023, jointly with Lizzie Reed and supervised also by Tudor Ioan Caba.

*Twins in Permutations* – J. Penchev, technical improvements of results from arXiv:2001.05589, awards at HSSIMI 2022-2023.

*Independence, Domination and Willcocks' problem in Spherical chess* – M. Drencheva, awards at HSSIMI 2022-2023.

*On the Discrete Channel Assignment Problem* – D. Hadzhi-Manich, award at HSSIMI 2023.

*Integral Factorial Ratios* – D. Pramatarova, awards at HSSIMI 2023-2024 and Secure Digital Future 21.

*Simplex Lock* – L. Gutsche, M. Spiridon, P. Toribio, PROMYS Europe 2017; V. Fukala, A. Kerekes, T. Patil, PROMYS Europe 2018.

- *Percolation on a large torus with long-range Erdős-Renyi edges*, supervised by Dominic Yeo, research supported by Department of Statistics, University of Oxford, July-August 2019. Talk at the Oxford Junior Probability Seminar, October 31<sup>st</sup> 2019.
- Mini-projects conducted during Oxford MSc Mathematics and Foundations of Computer Science studies:  
*Analytic Number Theory – Sierpinski's bound on the Gauss Circle Problem.*

*Algebraic Number Theory – Cyclotomic Class Groups, Fermat's Last Theorem and Catalan's Conjecture,  $Y^2 = X^3 - 7$  and a Thue equation, Units of Quadratic Rings.*

*Elliptic Curves – An approach to prove rank 2 of example curves, Influence of Birch-Swinnerton-Dyer Conjecture on the Rank of some families of Curves, Number of points of given order and 2-isogenies.*

*Additive and Combinatorial Number Theory – Bound of Heath-Brown and Szemerédi on Roth's Theorem.*

*Introduction to Cryptology – Ring Signatures and their use in Blockchain Technology.*

*Randomized Algorithms – A Chernoff Bound on Random Printer Scheduling, Some (hyper)graph colourings with the Method of Conditional Expectations and FPRAS.*

*Combinatorics – Variants of the Oddtown Problem.*

*Graph Theory – Vertex Colourings and Chromatic Polynomials of Edge-Weighted Graphs.*

*Probabilistic Combinatorics – Thresholds, Local Lemma and Janson's inequality in random edge colourings of a complete graph.*

- *A proof of concept for a Wolfram Mathematical Olympiad Problems Database* – Education Track, Wolfram Summer School 2022.
- (As a translator) S. Chobanov, S. Dimitrov, L. Lichev, *555 Problems in Geometry, Solutions based on "Geometry in Figures"*.
- *Newton's Method and GPS, Prony's Method* – Computational Mathematics Projects, Oxford Mathematics 2017.
- *Rankings of teams (Random variables on configurations around the Ordered Bell numbers)* – International Tournament of Young Mathematicians (ITYM) 2016, a prize for *Best Solution* to a problem.

## High School Olympic and Research Teaching – Lectures, Talks, Juror Activity

- *Number Theory Topics at Ross Mathematics*: Axiomatic Proofs, Euclid's Algorithm, Modular Arithmetic, Orders of Elements and Primitive Roots, Arithmetic Functions, Continued Fractions, Quadratic Residues, Finite Fields, Quadratic Number Rings and Polynomial Rings with Unique Factorization, Hensel's Lemma, Geometry of Lattices and Minkowski's Convex Body Theorem, Divisibility of Binomial Coefficients, Thue's Lemma, Ring Isomorphisms, Farey Fractions, Ideals in  $\mathbb{Z}[\sqrt{-5}]$ .

Analytic Number Theory (assisting Paul Pollack): Partial Summation, Estimates for Primes, Natural Density of Sets (e.g. a number  $n$  has  $\log 2$  chance to have a prime factor above  $\sqrt{n}$ ), Subgroups of  $(\mathbb{Z}/p\mathbb{Z})^*$ , Davenport's  $\frac{\sigma(n)}{n}$  distribution function.

- *Topics at PROMYS Europe*: Number Theory (most of the topics at Ross), Graph Theory and Group Theory (similarities with undergraduate courses at Oxford Mathematics), Enumerative Combinatorics, Decidability and Hilbert's 10th Problem.
- Talks at PROMYS Europe 2015-2020 (some of them also at Ross Mathematics 2021): *Mod 4 bias in the products of two primes*, *Major Arcs in Waring's Problem*, *Maximum Number of Singular Points on an Algebraic Curve*, *Bounds on the Size of Maximal Sidon sets*, *Constructions of Acute and Almost-Equilateral pointsets*, *Equiangular Lines*, *Mean Products*, *Finite projective planes*.
- *International Tournament of Young Mathematicians (ITYM)* – Member of the International Organizing Committee since 2018, mainly responsible for evaluating and editing all accepted problem proposals. Juror since 2018: evaluating students' written work and performance in presentation and oral discussions (student-student and student-jury) of research-flavoured partially open problems; my main areas of responsibility are Combinatorics, Geometry, Graph Theory and Number Theory.
- *Maths Beyond Limits (MBL)* – *Primitive Roots Modulo Prime* and *Topics in Analytic Number Theory*, Sep 2020, Milowka, Poland, see <https://mathsbeyondlimits.eu/wp-content/uploads/2021/04/2020-brochure-v2.pdf>;

*Consider the Polynomial*, Sep 2022, see [https://mathsbeyondlimits.eu/wp-content/uploads/2023/11/Brochure\\_2022.pdf](https://mathsbeyondlimits.eu/wp-content/uploads/2023/11/Brochure_2022.pdf)

*Applications of Bipartite Graphs and Turán's theorem*, April 2023, Konjic, Bosnia and Herzegovina, see <https://mathsbeyondlimits.eu/wp-content/uploads/2024/01/MBL-Balkans-2023-brochure-final.pdf>

*Applications of Euler Circuits and Hamiltonian Cycles*, September 2023, Rycerka Dolna, Poland, see <https://mathsbeyondlimits.eu/wp-content/uploads/2023/12/Brochure-2023.pdf>

In the April 2023 edition I assisted in grading an application problem for Canada/USA Mathcamp 2023 – some of its program coordinators are also MBL organizers.

- *Leader*: Junior Balkan Mathematical Olympiad (JBMO) 2023, PUMaC 2020\*, BMT 2021, International Zhautykov Olympiad (IZHO) 2024; *Deputy Leader*: Romanian Masters in Mathematics 2021, 2023, JBMO 2022, Olympiad of Metropolises 2021, IZHO 2022, 2023.
- *Olympiad Lectures* at the Institute of Mathematics and Informatics, Bulgaria – for IMO '16, '17, '19, '20, '21, '23 (Harmonic Quadrilaterals, Primitive Roots, Lovasz' Local Lemma, Non-Combinatorial Problems with Graphs, Greedy Algorithms, Hall's Theorem, Misc Problems in Algebra); Balkan MO '22 (Inversion, Moving Points); EGMO '17, '23; JBMO '16, '20, '21, '22, '23.
- Chair of the Jury at Bulgaria's Festival of Young Mathematicians, Sozopol – 2019, 2022, 2023; Jury member in 2016-2018.
- *Olympiad Lectures*: Bulgaria, Iran (December 2023), Pakistan (February-March 2024), Sweden (April 2024).
- *Olympiad Lectures in Bulgaria* – PMG Bourgas, SICademy, Minu Balkanski Foundation, Academy 21 Century.
- *Problems in International Competitions*: International Tournament of Young Mathematicians '17-'23; European Mathematical Cup '16, '17, '18, '22; Junior Balkan Mathematical Olympiad '16, '18, '21; IWYMIC '19.