

# Aryan Hemmati

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## Education

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**Sharif University of Technology**, BA in Pure Mathematics

Sep 2021 – Jan 2026 (Exp.)

- **Coursework:** Algebra I, Analysis I, II, Topology, Algebraic Topology, Manifold Geometry, Complex Analysis, Measure Theory, Real Analysis, Commutative Algebra (audit at IPM), Riemann Surfaces (audit at UT), Algebraic Geometry, Group Schemes, Algebraic Number Theory, Class Field Theory, Special Relativity, General Relativity, K-theory seminar (Étale Cohomology), Hyperbolic Dynamics
- GPA: 17.17/20

## Teaching Experience

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- **General Topology:** Teaching Assistant

During the spring semester of 2024, I worked as an assistant to Prof. Bahraini. I was tasked with holding TA classes, where I discussed complementary topics such as Kuratowski fan space and projective limit topology (some of the notes are available [here](#)).

- **Chaos Theory:** Teaching Assistant

I was a teaching assistant for this course during the fall semester of 2022. I was mainly tasked with grading the students' assignments and occasionally holding problem-solving sessions.

- **Advanced Programming:** Teaching Assistant

I was a teaching assistant of Dr. Boomeri during the spring semesters of 2023, 2024 and 2025. I designed the final project of the course, where I tried to focus on computational geometry and multi-threading while addressing issues of graphical workflow, concurrency, and optimization. The project documentations of several phases are available [here](#). Related codes and workshops are also available [here](#) and [here](#).

- **IMO Preparation courses:** Head of number theory team in Iran IMO summer camp

I have had numerous experiences teaching high school students contest-level mathematics and helping them master problem-solving skills required to participate in mathematical competitions such as IMO (International Mathematical Olympiad). I have also held problem-solving sessions on AOPS and IYSC. I was the head of the number theory team in IYSC where I gave lectures on analytical number theory, Dirichlet characters, Pólya-Vinogradov inequality, and various inequalities on  $\mathbb{R}$ . Some of my notes for the talks and relevant details are available [here](#).

- **Differential Topology:** Teaching Assistant (current semester)

## Experiences

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- I am currently doing my bachelor project with Prof. Bahraini on Geometric Invariant Theory and its approach through symplectic geometry, focusing on concepts of slope and stability of vector bundles and Kempf-Ness & Narasimhan-Seshadri theorems. My main source for the project was [an expository note by R. Thomas](#) on GIT. Through this project, I learned about the basics of representation theory, algebraic geometry, the theory of Lie groups, and various concepts of differential geometry such as connections and stability. I also had to learn a great deal of symplectic geometry. I'm writing my thesis on this project and it's yet to be completed.

## Relevant Studies

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During my bachelor years, I participated in several seminars (organized by me and my peers) where we all studied several chapters of a book and gave presentations on them. These seminars include:

- **Geometric Invariant Theory by D. Mumford, et al. (along with numerous articles):** Bachelor project
- **Differential Geometry of Curves and Surfaces by M.P. Do Carmo:** Personal study
- **Hyperbolic Dynamics:** Course in IPM (descriptions [here](#))
- **Algebraic Geometry by Q. Liu:** Course in IPM (given by H. Hedayatzadeh)
- **Group Schemes by W.C. Waterhouse:** Course in IPM (given by A. Partofard)
- **Class Field Theory by J. Anschütz:** Course in IPM (given by E. Shahoseini)
- **Algebraic Number Theory by J. Neukirch:** Study group in IPM (supervised by S. Gholami)
- **Introduction to Non-Archimedean Geometry by P. Achinger:** Seminar on Rigid Analytic Geometry
- **Fourier–Mukai transforms in Algebraic Geometry by D. Huybrechts:** Seminar on derived categories
- **Relativity: Special, General and Cosmological by W. Rindler:** Courses of special and general relativity
- **Knot Theory by K. Reidemeister:** Personal study

## Presentations

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- **Dessins d'Enfants and the Absolute Galois Group of rationals:** A thorough explanation to the theory of Dessins d'Enfants and their Galois actions on the absolute Galois group of rational numbers (notes available [here](#))
- **Continuous Geometry:** On axiomatizations of geometry, Von Neumann's work and Coordinatization theorem
- **On Furstenberg Transformation of the Torus:** On minimal but not uniquely ergodic diffeomorphisms and Furstenberg construction, given as a part of the Geometry and Topology Seminar organized by Prof. Amin Talebi
- **Elementary Proof of Hartogs Extension Theorem:** As a part of complex analysis course by Prof. Alireza Bahraini
- **A New Approach to P vs. NP: Geometric Complexity Theory:** On new approaches to complexity problems via algebraic geometry and representation theory
- **Node Connectivity Augmentation of Highly Connected Graphs:** Expository talk on a paper of the same name, as a part of a seminar on algorithm and computation organized by Prof. Morteza Alimi (notes available [here](#))
- **Graph embeddings and proof of Heawood coloring conjecture:** A presentation given in a seminar on graph theory organized by Prof. Javad Ebrahimi (notes available [here](#), along with some preliminaries and problems)
- **Coloring Discrepancy and Applications:** On different bounds and techniques for coloring discrepancy problem as a part of the Combinatorial Optimization course by Prof. Morteza Alimi (notes available [here](#))
- **Basic techniques on Principal Component Analysis:** As part of lectures on the Advanced Programming course. Notes, workshop video and all the relevant content are available [here](#) and [here](#).

## Awards and Events

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- **IPM Winter School on Algebraic Geometry & Number Theory:** A collection of three short courses given by IPM
- **IPM Conference of Moduli Spaces:** A series of talks about moduli problems, algebraic stacks and other topics
- **BICMR-IPM Conference on Geometry and Topology:** A series of talks on various topics of topology
- **Gold Medal in IMS contest 2024:** Rank 4
- **Silver Medal in the Iran's Mathematical Olympiad 2019:** Rank 18

## Voluntary Activities

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- **Problem-Solving Sessions for Calculus I,II, Differential equations:** Held midterm/final preparation sessions
- **Graph embeddings; An introduction to the theory of Dessins d'Enfants:** A basic talk on graph embeddings and Dessins and their application to solving Pell equations. This talk was given to high school students
- **A brief introduction to Topological Fixed Point Theory:** On history of fixed point theory and giving a combinatorial proof to Brouwer fixed point theorem. This talk was given to high school students (slides available [here](#))
- **Introduction to Lattice Theory:** A short course about lattice theory and related methods in elementary number theory through Minkowski theory and geometry of numbers. This course was given to high school students
- **Takeya needle problem; revisiting the concept of area:** An elementary talk about Takeya needle problem in 2D and 3D and related results by introducing concepts of measure and going through Perron method of creating Takeya sets of arbitrarily small measure and ending with a proof of the zero measure case (slides available [here](#))

## Technical Skills & Experience ([LinkedIn](#))

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- **Java Programming:** Advanced
- **Python Programming:** Advanced
- **LaTeX Programming:** Advanced
- **Go Programming:** Intermediate
- **Part-time junior software engineer in Balad**
- **Part-time optimization engineer in Reverso**

## Languages

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- **Persian:** Native
- **English:** Proficient
- **German:** Intermediate