

OM JOGLEKAR

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🌐 [my website](#)

Examination	Majors	Institute	Year	CPI/%
Graduation*	BS+MSc Dual degree	IIT Bombay	2021-2025	8.42
Intermediate	PCMC	Chethana PU College	2019-2021	100.00
Matriculation	-	Presidency School	2009-2019	97.80

**ongoing*

RESEARCH INTERESTS

I am very curious about all fields of pure mathematics, but specifically I am very enthusiastic about algebraic combinatorics and enumerative combinatorics. I also take interest in algebraic graph theory.

KEY COURSES UNDERTAKEN

Advanced Math Courses	Hyperplane arrangements, Hopf Algebra, Graph Theory, Species and Operads, Topics in Combinatorics, Enumerative Combinatorics, Algebraic Combinatorics, Category Theory*, Algebraic Graph Theory*
Intermediate Math Courses	Combinatorics, Representation Theory of finite groups, Topology, Galois Theory, Fourier Analysis, Functional Analysis, Module and Ring Theory, Lie Theory*, Non-Commutative Algebra*, Optimisation*
Basic Math Courses	Calculus I, Calculus II, Linear Algebra, Differential Equations, Real analysis, Basic Algebra, Complex analysis, Numerical analysis, Probability I, Ordinary differential equations, Partial Differential Equations, Measure Theory
Computer Science	Computer Programming and Utilization, Discrete Structures, Quantum Computing, Logic in Computer Science
Physics	Quantum Physics and its Applications, Basics of Electromagnetism

*** will be completed by April 2025*

PROJECTS AND RESEARCH EXPERIENCE

Hopf Algebras and Hyperplane Arrangements

Oct '23 - present

Self Reading Project | Instructor: Prof Swapneel Mahajan, Dept of Mathematics, IITB

- Reading about Hopf Algebras and linked concepts in Algebraic combinatorics. Explicitly reading from the book **Coxeter Bialgebras** by Swapneel Mahajan and Marcelo Aguiar
- Learning about **Hyperplane arrangements** and their connections to Hopf algebras. In particular, learning about category theoretical aspects of Hopf Algebra and developing enough theory to enter into the algebraic geometrical aspects of coxeter algebras
- In process of making a detailed report and short notes for my reading project and also preparing a video presentation on the same which I shall present
- Developed combinatorial proofs for multiple identities that seem to have no direct combinatorial proof, but rather a Hopf algebraic proof

Skolem Sequences

Jun '24 - Aug '24

Research Project – Polymath | Guide: Prof. Saad Mneimneh, Dept. of Computer Science, Hunter College, CUNY

- Discussed new theories related to the fairly untouched topic of **Infinite Skolem Sequences** and their variations under MIT professor Ben Brubaker
- Worked on connections of such sequences with **Steiner triple systems** and general combinatorial designs. Also explored the connections with Wythoff pairs
- Played around with variations and slightly tampered with the sequence to find connections with **rabbit sequences** and Fibonacci word sequence
- Worked in a team to develop some algorithms to produce a skolem sequence and fill the blanks using an arbitrary matrix

Theory of Symmetric Functions

Jun '24 - Jan '25

Reading project | Guide: Prof. Arvind Ayyer, Department of Mathematics, IISc Bangalore

- Read **Richard Stanley's** book on Enumerative Combinatorics (Chapter 7) and went deeper into the symmetric function related sections
- Explored more about the **RSK** algorithm, its symmetry and its other interesting applications. Besides the RSK algorithm, explored more about **Littlewood-Richardson** coefficients
- Developed an **algorithm** that can be applied by hand to generate the entire poset of Integer Partitions, ordered by the dominance order, of a positive integer.
- Explored the **representation theory** of the symmetric group and deduced a formula for the generating function of simple characters of the symmetric group

Algebraic Combinatorics

Oct '23 - Nov '24

Reading project | Guide: Dr. Om Prakash, Department of Mathematics, IIT Bombay

- Read **Richard Stanley's** book on Algebraic Combinatorics and going deeper into the commutative algebra related sections
- Simultaneously, completed a course in Algebraic Combinatorics with Prof Niranjana and went deep into the theory of the **Polynomial Method**
- Studied **Incidence Problems** in various types of fields in great detail. We explored incidence problems not only for lines, but also general varieties.
- Learnt about the **Combinatorial Nullstellensatz** and its plethora of applications. Further, studied Thue's theorem in its full generality

Solvable Lattice Models

Jun '23 - Aug '23

Research Project – Polymath | Guide: Prof. Ben Brubaker, Dept. of Mathematics, Massachusetts Institute of Technology

- Worked on the topic of solvable lattice models under MIT professor Ben Brubaker
- Worked on finding **partition functions** of various lattice models and figuring out which lattice models generate **symmetric partition functions**
- Extending the lattice model boundary set conditions to multiple allowable states and working on their partition functions
- Developed further theory using the **Yang-Baxter equation** to find additional results

Promoting Undergraduate Mathematics in High School

Jul '22 - Jul '23

Summer Undergraduate Research Project | Guide: Prof. Rekha Santhanam, Dept. of Mathematics, IITB

- Worked in a team of **11 Math UGs** to introduce UG math concepts to the school curriculum
- Studied the existing curriculum to identify math topics to be introduced in a fun and easy way to high school students who will be exploring probability soon enough
- Worked on introducing **Probability and game theory** concepts to students in the form of a **novel**
- **Published** the novel 'The Pirate Ship'. Its sequel 'A Mathematical Spectacle' has been approved and is ready to be published as a second book that has higher concepts of probability

Intro to Combinatorics

May '22 - Jul '22

Reading Project – Summer of Sciences | Guide: Dhawal Singh, Manager, MnP club, IIT Bombay

- Learnt about core concepts of Combinatorics including Stirling numbers and basic graph theory. Complemented it with basics of Extremal graph theory which included the **Zarankiewicz problem** and the **Erdős–Stone theorem**
- Grasped fundamental concepts of Combinatorics like Pigeon hole principle, partitions, binomial theorem. Worked on theory of partitions and ventured into some algebraic number theory to satisfy my needs
- Learnt about cycles in permutation, the sieve formula (PIE) and generating functions in depth
- Made a **video report** on Ferrers' shapes and presented a new idea and a proposition on it

Basic Number Theory

May '23 - Jul '23

Reading Project – Summer of Sciences | Guide: Suraj Panigrahy, Doctoral AURAA, Mathematics Association IIT Bombay

- Learnt about core concepts of Number Theory including Fermat's theorem's and congruences
- Explored fundamental concepts of Number Theory like Quadratic fields and Generating functions
- Learnt about series of primes, elliptic curves and partitions to name a few topics
- Made a **video report** on a particular topic of my choice in Number Theory

Remote Controlled Plane

Sep '22 - Nov '22

Team project - Aeromodelling Club, Institute Technical Council

- Working in a team of 4 that includes 2 exchange students from the **Denmark Technical University** to **optimize aircraft** for stable flight and ease of control given the constraints
- Designing and maneuvering the aircraft considering the drag equation and various flight affecting factors of the planform and fuselage like planform shape, aspect ratio, and dihedral angle

Equity Research Project

Aug '22 - Nov '22

Competition organised by Finance club, Undergraduate Academic Council (UGAC), IIT Bombay

- Analysed the firm and developed a **stock pitch** presentation using various **analytical techniques** of valuating stocks like Du-Pont analysis, Porter's analysis, SWOT analysis, DCF valuation method
- Finished in **top 10** and advanced to the finals where we presented our stock to a panel of experts

Bubble Trouble

Dec '21 - Feb '22

CS101 course project | Guide: Prof. Parag Kumar Chaudhuri, Department of CSE, IIT Bombay

- Used **Object-Oriented programming** in conjunction with STL libraries and graphics packages
- The aim was to destroy all bouncing bubbles by splitting them using bullets shot by a shooter
- Included difficulty to add features like bubble splitting, health, timer, bubbles shot score counter

TECHNICAL SKILLS

Languages	Python*, Java, C/C++
Web Technologies	HTML, CSS
Database	SQL*
Softwares	MATLAB, SageMath
Libraries	C/C++: simplecpp, Turbo Python: NumPy, Pandas

* under-process of learning

POSITIONS OF RESPONSIBILITY

Guide and Teacher of Mathematics | National Service Scheme (NSS) | IIT Bombay Aug '22 - Dec '22

Teaching students of grade 12 and helping them prepare for JEE

- Mentoring and helping **40+** financially constrained students of grade 12 and solving their doubts
- Helping them clear their concepts and teaching them the topics they are facing difficulties in

Teaching Assistant | Math Department, IIT Bombay

Teaching Assistant for multiple courses in the Math Department

- Served as a Teaching assistant for various courses in the Math Department including MA109, MA111 and MA105
- Involved conducting **problem solving** tutorial sessions every week for a batch of students
- Revising the course content and clarifying doubts related to the course during the tutorial sessions

DAMP mentor | Math department, IIT Bombay

May '23 - present

Department Academic Mentorship Program, Mathematics department, IIT Bombay

- **Mentoring** sophomores with their academic difficulties and providing credible **counsel** for their personal issues and mental health
- Spearheaded and executed the **sophomore 101** session as a speaker for the topic of branch change in the session during the year 2023
- Trying to curate help sessions and doubt-clearing sessions for my mentees in some of the hardest courses for that semester

Summer of Sciences mentor | MnP Club, IIT Bombay

May '23 - Jul '23

Mentor for projects listed under the Summer of Science event, Math and Physics club, IITB

- Mentoring students for two topics - **Linear Algebra** and **Sets and Category theory**
- Guiding my mentees on how to go about doing their project and clearing occasional doubts
- Pointing out relevant resources and references to aid the projects of the mentees
- Providing **feedback** after reviewing their mid-term and end-term project reports and also evaluating their video submission in order to provide the completion certificate

Campaign Coordinator | Abhyuday | IIT Bombay

Jan '22 - Jan '23

Largest student-run social body for leadership and impact in India | Patronage: UNICEF, UNESCO

- Working in a Team of **50+** volunteers to conduct campaigns to bring out a change in the society
- Headed a group of **20+** volunteers to organize and conduct a **food distribution drive** in collaboration with **Robinhood Army** in the slums of Powai and managed the children
- Contacted **10+** schools for executing **Career Counselling Campaign** for underprivileged children
- Took lead and managed the debating event in the **Abhyuday Social Fest**

EXTRA CURRICULAR ACHIEVEMENTS

- Practiced **Taekwondo** for four years and awarded a **Black Belt** in it by Kukiwon, South Korea
- Currently pursuing a course in **French** and **Japanese**, which will lead to an A1 level certificate
- Learning **Sanskrit** from the Non-Formal Sanskrit Education Cell, IIT Bombay which has tied up with CSU
- Placed in the top 10 in the **Pan-IIT Cycling** Competition (June 2022), which was organized by IIT BHU
- Represented Presidency School RT Nagar as a part of its **football team** in inter school matches
- Participated in and won gold and silver medals in various subject Olympiads at the school level
- Availed the Scholarship for Higher Education (SHE) under **INSPIRE** for performing in top 1% in Class XII Board Examination and securing an all-India rank of less than 10k in JEE Advanced
- Completed a 2 year long National Cadet Corps (**NCC**) course to obtain an A grade certificate
- Completed a 1-year course on health and fitness conducted by **NSO**.
- Placed first in an all-India quiz organised by **Presenova** and hosted by quiz master **Pick Brain**
- Participated in an all-Karnataka state level **roller skating** competition