

# Soham Chatterjee

✉ soham.chatterjee@tifr.res.in

🌐 sohamcho8.github.io

in profile

🐙 sohamch08



## Education

- 2024 – current 📖 **I-Ph.D Computer Science, Tata Institute of Fundamental Research, Mumbai**
- 2021 – 2024 📖 **B.Sc. Math and Computer Science, Chennai Mathematical Institute**
- 2018 – 2020 📖 **Higher Secondary Education (12<sup>th</sup> Standard), Baranagar Narendranath Vidya-mandir, Kolkata**
- 2008 – 2018 📖 **Secondary Education (10<sup>th</sup> Standard), Baranagar Ramakrishna Mission Ashrama High School, Kolkata**








## Research Interest

Algorithms and Complexity Theory with Algebraic nature, Error Correcting Codes, Pseudorandomness, Polyhedral Combinatorics, Analysis of Boolean Functions




## Research Internships

- Summer 2024 📖 **Worked on *Derandomization of Isolation Lemma over Polytopes***  
Guide: Dr. Rohit Gurjar, IIT Bombay  
In this project I tried to extend the idea of bounding the number of vectors in the integer lattice which has  $L_1$  norm less than twice the shortest vector for 0-1 matrices with  $k$ -column sum to derandomize isolation lemma over more general polytopes. Additionally I read about isolating a path connecting in a black-box layered graph.
- Dec'23-Jul'24 📖 **Project on *Quantum Property Testing of Junta Functions and Partially Symmetric Functions***  
Guide: Dr. Arijit Ghosh, ISI Kolkata  
In this project I learned about Quantum Boolean Functions and some basics of Quantum algorithms for property testing from the Survey by Montanaro-Osborne, 2008. I learned about Classical and Quantum Junta Function testing. We worked on finding a more efficient Quantum Algorithm for testing Paritally symmetric boolean functions by improving the classical algorithm in Blais-Weinstein-Yoshida's Paper.
- Summer 2023 📖 **Reading project on *Factorization of Arithmetic Circuits***  
Guide: Dr. Nitin Saxena, IIT Kanpur  
In the project I learned factorization techniques and closure of VP and VBP under factorization. I also read closure of VF with bounded individual degree from Oliveira, 2016 paper and we worked on removing the bounded individual degree condition
- Dec 2022 📖 **Reading project on *Computational Number Theory and Algebra for Algebraic Complexity Theory***  
Guide: Dr. Nitin Saxena, IIT Kanpur  
I did a basic study of Computational Number Theory and Algebra from Nitin Saxena's course and about Arithmetic Circuits from Amir Shpilka's Survey and Ramprasad Saptharishi's Survey on Arithmetic Circuits.

## Talks and Presentations

- 2026  **Universal Optimality of Dijkstra using Fibonacci Priority Queue with Working Set Property**  
Oral Qualifier Presentation. Paper by Haeupler, Hladík, Rozhoň, Tarjan, Tětek, 2024. FOCS Best Paper.  
Slides: [PDF]
- 2025  **Super Polynomial Lower Bound on Traveling Salesman Polytope**  
Coursework Presentation (TIFR): Combinatorial Optimization. Paper by Fiorini, Massar, Pokutta, Tiwary and Wolf, 2012  
Slides: [PDF]
-  **Bounds on Price of Anarchy using Linear and Quadratic Programming**  
Coursework Presentation (TIFR): Algorithmic Game Theory. Paper by Kulkarni and Mirrokni, 2015.  
Slides: [PDF]
-  **Bipartite Matching is in Quasi-NC**  
TIFR Student Seminar. Paper by Stephen A. Fenner, Rohit Gurjar and Thomas Thierauf, 2016.
- 2024  **Hensel and Newton Methods in Valuation Rings**  
Coursework Presentation (CMI): Algebra and Computatiopn. Paper by J von zur Gathen, 1984
- 2023  **Coursework Presentation (Algorithmic Coding Theory II)**  
Algebraic Geometric Codes, jointly presented by Me and Shree Ganesh S J  
Report: [PDF]
-  **Coursework Presentation (Parallel Algorithms anc Complexity)**  
"Iterated Mod Problem" by Karloff and Ruzzo  
Slide: [PDF]

## Attended Workshops

- 2025  HDX and Codes, ICTS
- 2024  FSTTCS, IIT Gandhinagar
- Jan-Apr 2024  Quantum Computing Semester, CMI

## Relevent Courses

### • TIFR Courses

- |  |  |
|--|--|
| - Mathematical Foundations of Computer Science | - Computational Complexity             |
| - Algorithms                                   | - Algebra, Number Theory & Computation |
| - Probability                                  | - Combinatorial Optimization           |
|  | - Algorithmic Game Theory              |

I have followed the following courses:

- |                               |                                       |
|-------------------------------|---------------------------------------|
| - Algebraic Complexity Theory | - Polynomial Methods in Combinatorics |
|-------------------------------|---------------------------------------|

## • CMI Courses




### Math Courses:

- Linear Algebra (Algebra 1)
- Group Theory (Algebra 2)
- Ring and Field Theory (Algebra 3)
- Commutative Algebra
- Real Analysis (Analysis 1)
- Analysis in Euclidean Space (Analysis 2)
- Analysis in Metric Space (Analysis 3)
- Complex Analysis
- Discrete Mathematics
- Calculus
- Probability Theory
- Topology
- Differential Equations



### Computer Science Courses:

- Design and Analysis of Algorithms
- Theory of Computation
- Complexity Theory
- Parallel Algorithms and Complexity
- Expander Graphs and Application
- Algorithmic Coding Theory (Two Parts)
- Algebra & Computation
- Quantum Algorithmic Thinking
- Quantum Information Theory
- Functional Programming with Haskell
- Advanced Programming with Python
- Programming Language Concepts (Java, Concurrent Programming, Lambda Calculus)



## Achievements

- 2024  Ranked 5 in the Joint Entrance Screening Test I-PhD exam for Theoretical Computer Science.
- 2021  Got selected for NISER for Bachelors through the NEST exam.
- 2020  Ranked 28 in 12<sup>th</sup> Statistics Olympiad organised by C R Rao Advanced Institute of Mathematics, Statistics and Computer Science.

## Miscellaneous

- 2023  **Coursework Project (Quantum Algorithmic Thinking)**  
**Qiskit Implementation of Quantum Circuit of Modular Exponentiation:** Implemented the paper “Quantum Networks for Elementary Arithmetic Operations” by Vedral, Barenco and Artur  
Code: [Link]
-  **Coursework Project (Quantum Algorithmic Thinking)**  
**Qiskit Implementation of Kushlevitz and Mansour Algorithm:** Implemented the paper “Learning Decision Trees Using The Fourier Spectrum” by Kushilevitz and Mansour  
Code: [Link]

## Computer Skills

- Languages   $\LaTeX$ (Advanced), Python (Intermediate), Qiskit (Intermediate), Haskell (Basic), Java (Basic), C (Basic), Unix/Linux Shell Scripting, HTML (Basic), CSS (Basic).
- Tools  Git, Basic works in terminal, VIM, Obsidian