Soham Chatterjee

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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^{th} Standard), Baranagar Narendranath Vidyamandir, Kolkata**

2008 – 2018 **Secondary Education (10^{th} Standard), Baranagar Ramakrishna Mission Ashrama High School, Kolkata**

Research Intereset

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 of VP and VBP under factorization. I also read closure of VF with bounded individual degree from Oliviera, 2016 paper and we worked on removing the bounded individual degree condition

Dec 2022 Reading project on *Computational Number Theroy and Algebra for Algebraic Comlexity 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

2024 **Coursework Presentation (Algebra and Computation)**
"Hensel and Newton Methods in Valuation Rings" by J von zur Gathen

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

2024 FSTTCS, IIT Gandhinagar

Jan-Apr 2024 Quantum Computing Semester, CMI

Relevent Courses

- **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
- Calculus
- Probability Theory
- Topology

Computer Science Courses:

- Discrete Mathematics
- Design and Analysis of Algorithms
- Theory of Computation
- Complexity Theory
- Parallel Algorithms and Complexity
- Expander Graphs and Application
- Algorithmic Coding Theory (Two Parts)
- Quantum Algorithmic Thinking
- Quantum Information Theory

- **TIFR Courses**

- Mathematical Foundations of Computer Science
- Algorithms
- Probability

I have followed the following courses:

- Algebraic Complexity Theory
- Polynomial Methods in Combinatorics

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.

Achievements (continued)

2020 Ranked 28 in 12^{th} 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