Soham Joshi

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Education

Indian Institute of Technology, Bombay *(2021-2025)*
Major & Honors in Computer Science and Minor in Mathematics
Current Major CPI/GPA after 6 semesters: 9.28/10

Research Interests

Algorithms & Complexity, Game Theory, Graph Theory, Markov Decision Processes

Key Projects

Submodular Partitioning Problems *Summer '24*
Guide : Prof. Karthekeyan Chandrasekaran | Research Internship *U of I, Urbana-Champaign*
- Examined **multi-way cut** problem for monotone submodular functions and showed a novel approximation algorithm
- Showed oracle hardness, better than **1.1-approximation** for the problem requires exponentially many queries
- Expected to result in a publication in the near future crediting me as a **co-author**

Evolutionary Game Theory (arXiv) (doi) *Summer '23*
Guide : Prof. Krishnendu Chatterjee | Research Internship *Chatterjee Group, IST Austria*
- Examined the **moran process** with birth-death and death-birth updating for weighted population networks
- Showed robust, modular amplifiers for **birth-death** and **death-birth** updating resolving an important open problem
- Showed existence of quantities that are impossible to improve for death-birth and birth-death updating simultaneously
- **Accepted** by PLOS Computational Biology, a **peer reviewed journal** for publication

Extension of Matroids (Report) (Survey) *Autumn '23 & Spring '24*
Guide : Prof. Rohit Gurjar | Research Project *IIT Bombay*
- Proved that if matroids have a **small extension** complexity then the **matroid union** also has a small extension
- Studied the extension complexity for transversal, regular matroids and exploring it for **dilworth truncation**
- Surveyed **randomised communication** based protocols for finding extension complexity of $k - l$ sparsity matroids

Distributional safety for MDPs *Autumn '23 & Spring '24*
Guide : Prof. S. Akshay | Research Project *IIT Bombay*
- Examining algorithms for template based approaches to **affine invariant synthesis** for affine safety objectives
- Proved that for 2-state MDPs, distributional strategies with initialised safety, **memoryless** strategies suffice
- Examined the **computational complexity** of the problem for the affine safety of general MDPs
- Expected to result in a publication in the near future crediting me as a **co-author**

Scholastic Achievements

- Received the **Institute Academic Award** for **Institute Rank 1** among **1400+** students *(2022)*
- Secured **5 AP (Advanced Proficiency)** grades awarded to **top 1%** among 1400+ students *(2022)*
- Secured **All India Rank 46** in Joint Entrance Examination Advanced amongst **0.25 million** candidates *(2021)*
- Achieved **All India Rank 39** and was awarded the prestigious **KVPY fellowship** by IISc Bangalore, India *(2021)*

Olympiads

- Qualified for the **Mathematics Olympiad Orientation Camp** (MOOC) conducted by HBCSE *(2021)*
- Cleared **Indian Olympiad Qualifier in Mathematics** (IOQM) conducted by MTA(I) with **State rank 1** *(2021)*
- Among **top 64** students in the country in the **Indian National Chemistry Olympiad** (INChO) *(2021)*
- Attended the **Chemistry Olympiad Orientation Camp** (COOC) conducted by HBCSE *(2021)*

Teaching & Expository Experience

Teaching Assistant *Autumn 2022 - Spring 2023*
Dept. of Mathematics | Prof. Sanjoy Pusti, Prof. Niranjan Balachandran & Prof. Dipendra Prasad *IIT Bombay*
- Worked as a **TA** for **Calculus-I (MA109)**, **Calculus-II (MA111)** & **Linear Algebra (MA106)** courses
- Conducted **weekly interactive and problem solving sessions** for 45+ 1st year UG students students

Relevant Courses

Theoretical Computer Science: Data Structures and Algorithms, Discrete Structures, Design and Analysis of Algorithms, Logic for CS, Extremal Combinatorics, Automata Theory, Applied Algorithms, Spectral Graph Theory, Approximation Algorithms

Mathematics: Linear Algebra, Calculus-I, Calculus-II, Differential Equations, Real Analysis, General Topology, Complex Analysis, Numerical Analysis

Machine Learning: Data Analysis and Interpretation, Introduction to AI and ML