

Sayak Chakrabarti

+91 877758 2670 | sayak@iitk.ac.in | github.com/sayaksc

EDUCATION

Indian Institute of Technology, Kanpur <i>Integrated B. Tech- M.Tech in Computer Science and Engineering</i>	2017-2022 (<i>expected</i>) CPI: 8.8/10.0
South Point High School, Kolkata <i>All India Senior School Certificate Examination, CBSE Board</i>	2017 Score: 93.2 %

PUBLICATIONS

- Aditya Gulati, **Sayak Chakrabarti**, Rajat Mittal, On algorithms to find p -ordering, to appear in *7th Annual International Conference on Algorithms and Discrete Applied Mathematics, 2021*
- Soumendu Sundar Mukherjee, **Sayak Chakrabarti**, Graphon Estimation from Partially Observed Network data, *arXiv preprint arXiv:1906.00494*

ACADEMIC ACHIEVEMENTS

- **2020 Research Fellowship** at Max Planck Institute of Software Systems
- **2017 Secured All India Rank of 181 in Joint Entrance Exam, Advanced** among 200,000 candidates
- **2017 Secured All India Rank of 287 in Joint Entrance Exam, Main** among 1.2 million candidates
- **2017 Secured Rank 10 in West Bengal Joint Entrance Examination** among 150,000 candidates
- **2017 Qualified Indian National Physics Olympiad (INPhO)**, among 34 students to be selected from India, and attended **Orientation cum Selection Camp (OCSC Physics)**
- **2016 Qualified Indian National Mathematical Olympiad (INMO)**, among 30 students to be selected from India
- **2015 Secured All India Rank 115 in Kishore Vaigyanik Protsahan Yojana (KVPY)** among 100,000 candidates

RESEARCH EXPERIENCE

Root Finding of Polynomials Prof. Nitin Saxena, <i>Dept. of Computer Science and Engineering, IIT Kanpur</i>	Aug 2020 – Present <i>Kanpur, India</i>
<ul style="list-style-type: none">• Studied algebraic geometry and the complexity of Hilbert's Nullstellensatz• Reviewed literature on algorithms to factorize polynomials in fields and upto modulo p^4, and calculate basic irreducible factors modulo prime powers• Currently working on finding a root of a system of bivariate polynomials modulo primes using algebraic and algebraic geometric techniques	
Root Sets, p-ordering and Factorization Prof. Rajat Mittal, <i>Dept. of Computer Science and Engineering, IIT Kanpur</i>	Aug 2019 – Present <i>Kanpur, India</i>
<ul style="list-style-type: none">• Learnt about Root sets of polynomials modulo prime powers, their behaviours and some properties• Studied the work done on factorization modulo primes and lifting these to modulo prime powers• Attempted to find a method of factorization of polynomials using representative roots such that the factorization gives maximum linear factors modulo a prime power• Solved this problem upto degree 3 and attempted to lift to higher degree polynomials• Discovered algorithms to find p-ordering of subsets of integers, also represented in succinct form	
Continuous Skolem Problem for arbitrary dimensions Prof. J��l Ouaknine, <i>Max Planck Institute of Software Systems</i>	May 2020 – July 2020 <i>Saarbr��cken, Germany</i>
<ul style="list-style-type: none">• Remotely worked on the continuous Skolem problem for higher dimensions in Prof. Ouaknine's research group under the supervision of Dr. Eike Neumann and Dr. Engel Lefauchaux• Learnt about Real Algebraic Geometry with an emphasis on Semi-algebraic sets and their decomposition• Studied the work done upto dimension 8 and attempted to extend it to arbitrary dimensions using Schanuel's conjecture and Leon Ehrenpreis' conjecture• Attempted to prove the decidability of zeroes of exponential polynomials for low codimension cases• Devised a parameterization of a semi-algebraic set which contains the zeroes of the given function	

- Extended a proposition from "Real Algebraic Geometry" by Bochnak, Coste and Roy to show that the parameterized semialgebraic set can be extended to $\bar{0}$

Graphon Estimation

Dec 2018 – Present

Prof. Soumendu Sundar Mukherjee, *Interdisciplinary Statistical Research Unit, ISI Kolkata*

Kolkata, India

- Learnt about Graphons that are symmetric measurable function $f : [0, 1]^2 \rightarrow [0, 1]$ used to denote network edge probability of a dense graph
- Learnt about **graphon estimation methods** including Universal Singular Value Thresholding, Stochastic Blockmodel Approximation, Matrix Completion, Neighbourhood Smoothing etc.
- Extended the **Neighbourhood Smoothing** technique for graphon estimation proposed in "Estimation of Network Edge Probabilities by Neighbourhood Smoothing" by Zhang et al.
- Used the **extended Neighbourhood Smoothing** algorithm on partially revealed graphs to estimate the underlying graphon with high accuracy, both on simulated networks from standard graphon functions and real networks
- Estimated graphons using various existing alternative methods and compared those against the proposed algorithm

SELECTED PROJECTS

Linear Cryptanalysis on Logic Locking

May 2019 – Oct 2019

Prof. Pramod Subramanyan, *Dept. of Computer Science and Engineering, IIT Kanpur*

- Learnt about various Logic Locking techniques
- Reviewed literature on **SAT-attack** on Logic Lockings
- Attempted to break logic locking encryption by using Linear Cryptanalysis
- Used Genetic algorithm and MaxSAT solvers to improve linear approximation of for encrypted circuits
- Tested proposed attack on various benchmark circuits

Breaking Cryptosystems | Course Project, Modern Cryptology

Jan 2019 – Apr 2019

Instructor: Prof. Manindra Agarwal, *Dept of Computer Science and Engineering, IIT Kanpur*

- Solved a Dungeon and Dragons based game where in each stage a cryptosystem was to be broken to advance to next stage
- Broke **Substitute cipher, Block Substitution Cipher, Substitution Permutation Cipher, DES Cryptosystem** (using Differential Cryptanalysis), **SASAS Cipher** (AES-like cryptosystem), **RSA Cryptosystem** (with low public exponent, using Coppersmith's attack)

RELEVANT COURSEWORK

Algebraic Number Theory, Computational Number Theory and Algebra, Geometric Topology, Modern Cryptology, Discrete Mathematics, Data Structures & Algorithms, Algorithms II, Theory of Computation, Randomized Methods in Computational Complexity*, Arithmetic Geometry* * - ongoing courses

TECHNICAL SKILLS

Programming: Python, C/C++, R, Haskell, Verilog, PHP

Tools: \LaTeX , Bash, Git, MySQL

Libraries: Pytorch, Tensorflow, Keras, Numpy, OpenCV

EXTRA-CURRICULAR ACTIVITIES

Volunteer | Shiksha Sopan

Aug 2019 – Mar 2020

- Volunteered to teach English at a school under Shiksha Sopan, an NGO providing education to underprivileged children

Project Mentor | Association for Computing Activities

Jan 2019 – Apr 2019

- Guided a group of first year students in topics of Theoretical Computer Science

Academic Mentor | Counselling Services

Aug 2018 – Apr 2019

- Helped students facing academic problems by conducting doubt clearing sessions and one-to-one mentorship regarding courses on Mathematics

Student Guide | Counselling Services

Jul 2018 – Apr 2019

- Helped 4 freshmen students get used to campus life and quickly adjust to college environment