

Sayan Mukherjee

AFFILIATION/ PERSONAL INFORMATION	Researcher Blueqat Research, Blueqat Inc, Shibuya 2-24-12 39F, Tokyo 150-6139	Web: sayan.mukherjee.moe Email: sayan@blueqat.com LinkedIn: sayanmukherjee1995 ORCID: 0000-0001-8838-0455 Github: Potla1995 Google Scholar: 1U95To0AAAAJ DOB: October 21, 1995		
RESEARCH AREAS	Quantum Computing and Quantum Information, Machine Learning, Graph Theory and Optimization.			
EDUCATION	Ph.D. in Mathematics , University of Illinois at Chicago, USA August 2016 – May 2021 (GPA: 4.00/4.00) Department of Mathematics, Statistics and Computer Science Thesis Title: <i>Extremal Problems for Graphs and Hypergraphs</i> Advisor: Dr. Dhruv Mubayi 851 S. Morgan St., Chicago, IL 60607 Contact: dgs-mscs@uic.edu , +1-312-996-3041 Bachelor of Mathematics , Indian Statistical Institute, Bangalore, India June 2013 – May 2016 (Absolute score: 87.2%, first division with distinction) Statistics and Mathematics Unit 8th Mile, Mysore Road, Bangalore 560059 Contact: statmath@isibang.ac.in , +91-80-26985440			
WORK EXPERIENCE	June 2021– current	Researcher <i>Company Name:</i> blueqat Inc., Japan <i>Location:</i> Remote - Doing fundamental theoretical research on Quantum Computing and Machine Learning. - Publishing papers, giving presentations on the research at conferences and journals, and writing expository and advanced tutorials on quantum computing. August 2022 – current	Visiting Joint Researcher <i>University:</i> The University of Tokyo, Japan Fundamental research on Simulation of Quantum Circuits using Tensor Networks, Graph Theory and Machine Learning at the School of Sciences. June–August 2020	Quantum Computing Intern <i>Company Name:</i> Elyah <i>Location:</i> Remote - Designed and implemented quantum algorithms solving problems with real life applications using Grover Search. - Coded in qiskit, pyquil and braket-sdk, and tested said algorithms on both simulators and quantum computers.
SKILLS	Independent and collaborative research, Programming (Python, C++), Computer Algorithms, Machine Learning, Graph Theory, Optimization.			

RESEARCH
EXPERIENCE

- April
2022
- IDEAL Workshop on Clustering**
Organizer: The Institute for Data, Econometrics, Algorithms, and Learning
Location: Remote.
- Attended workshop on clustering algorithms in Theoretical Machine Learning. Lecturers from different academic institutes and companies discussed the recent progress on problems related to clustering.
- July
2019
- Polynomial Methods in Combinatorics**
Workshop Lecturers: Adam Sheffer, Joshua Zahl
Location: University of California, Berkeley.
- Attended Summer Graduate School at the Mathematical Sciences Research Center via recommendation by the UIC Math department.
 - Studied applications of the polynomial method in combinatorics and analysis, and attended daily collaborative problem solving sessions.
- June
2018
- SIAM Conference on Discrete Mathematics**
Organizer: Society for Industrial and Applied Mathematics
Location: University of Colorado, Denver.
- Attended conference talks on the most recent advances in discrete mathematics, delivered by experts as well as graduate students working on the field.
- June
2017
- Random Graphs and Probabilistic Methods**
Workshop Lecturers: Dimitris Achlioptas, Louigi Addario-Berry, Andrzej Rucinski, Lutz Warnke
Location: University of Toronto
- Attended Summer Graduate School at the Fields Institute for Research in Mathematical Sciences through a competitive selection procedure.
 - Learned several recent techniques in random graphs and probabilistic methods via lectures and problem sessions organized at the summer school.
- May–July
2016
- Stochastic Modeling of Biochemical Pathways**
Mentor: Dr. Rajat K. De, Machine Intelligence Unit,
Location: Indian Statistical Institute, Kolkata.
- Studied modeling of biochemical pathways as Markov Chains.
 - Explored the problem of time required for a biochemical system to return to its original state. Solved the problem for linear cyclic reactions, leading to a journal publication.
- June–July
2015
- Graph Theory as a Visiting Research Student**
Mentor: Dr. Amitava Bhattacharya, Dept. of Mathematics,
Location: Tata Institute of Fundamental Research, Mumbai.
- Studied Matching Theory, Flows and Networks, Vertex and Edge-Coloring, and Combinatorial Nullstellensatz.
 - Solved problems in these topics as suggested by the guide.
- Jun–July
2013
- Image Processing in Matlab using Morphological methods**
Mentors: Dr. Abhijit Kar, Dept. of CS, Jadavpur University,
Dr. R.K. Chatterjee, Faculty of CS, Birla Inst. Tech.,
Dr. Somojit Saha, Neurologist.
Location: Jadavpur University, Kolkata.
- Studied “Image Processing in Matlab” by Gonzalez-Woods-Eddins to learn the basics of Morphology.
 - Designed an algorithm for segmentation of white matter from MRI images using modified Regiongrow techniques.

PROFESSIONAL SERVICE	Reviewer, <i>Discrete Mathematics, Elsevier</i> Endorser, <i>Combinatorics Publications, arXiv</i>
HONORS AND AWARDS	<p>2016 Merit Award, Fall 2016, UIC (Based on academic performance and MS exam)</p> <p>2013–2016 KVPY Fellowship from Govt. of India (Rank: 100 (India), Qualified for BS at Indian Institute of Sciences)</p> <p>2011 Sharygin Geometry Olympiad, online correspondence round (Rank: 4 (intl.), score: 53/63)</p> <p>2011–2013 Indian National Mathematical Olympiad (Merit Certificate Holder for 2012 and 2013)</p>
PRESENTATIONS AND TALKS	<p>2022 Tight Query Complexity Bounds for Learning Graph Partitions 35th Conference of Learning Theory Presented joint work with Xizhi Liu, University of Warwick on graph learning problems at the conference on July 2, 2022.</p> <p>2021 Turán Numbers of Hypergraph Suspensions of Even Cycles University of Delaware Invited to give a talk at the Discrete Mathematics seminar at the University of Delaware on the preprint titled the same as above on April 21, 2021.</p> <p>2020 Learning Circuits using Value Injection Queries Final Presentation, Introduction to Artificial Intelligence, UIC Presented a paper titled the same as above, authored by Dana Angluin, James Aspnes, Jiang Chen, Yinghua Wu, <i>Journal of Computer and System Sciences 75 (2009): 60-77</i> as a final exam for the Fall 2019 course on Data Science lectured by Lev Reyzin.</p> <p>2019 Spectral Partitioning of Random Graphs Final Presentation, Mathematical Foundations of Data Science, UIC Presented a paper titled the same as above, authored by Frank McSherry, <i>Foundations of Computer Science 2001: 529-537</i> as a final exam for the Fall 2019 course on Data Science lectured by Lev Reyzin.</p> <p>2019 An Invitation to Combinatorics Graduate Student Colloquium, UIC Gave a talk to around 30 first year graduate students introducing some of the recent research in Combinatorics in the UIC Math department.</p> <p>2018 Analyzing Growth of an Extremal Function for Hypergraphs Graduate Combinatorics/ Math and CS Seminar, UIC Presented research leading to the paper titled <i>On Maximum \mathcal{H}-free Subgraphs</i> to an audience of size roughly 10 consisting of graduate students and professors working on combinatorics and computer science in the department.</p> <p>2018 An introduction to the Turán problem on graphs Graduate Theoretical CS Seminar, UIC Gave a survey of Turán problems on graphs to graduate students and professors working on combinatorics and computer science in the department.</p> <p>2017 The emergence of linearly sized paths in the “supercritical regime” for the random graph $G(n, p)$ Graduate Theoretical CS Seminar, UIC Presented recent research on emergence of linear paths in random graphs aimed at graduate students and professors working on combinatorics and computer science in the department.</p>

TEACHING
EXPERIENCE AT
UIC

Fall	2016	Teaching Assistant, Calculus I
Spring	2017	Teaching Assistant, Calculus I
Fall	2017	Teaching Assistant, Calculus II
Spring	2018	Teaching Assistant, Calculus II
Fall	2018	Grader, Applied Linear Algebra, Graph Theory
Spring	2019	Teaching Assistant, Python Programming, Data Structures
Fall	2019	Teaching Assistant, Data Structures, Precalculus, Graph Theory
Spring	2020	Grader, Combinatorics, Codes and Cryptography
Summer	2020	Grader, Computer Algorithms I
Fall	2020	Teaching Assistant, Data Structures, Graph Theory, Grader, Computer Algorithms I
Spring	2021	Teaching Assistant, Calculus for Life Sciences

Duties

- Lead and instruct over twenty different discussion sessions of 20-25 students each, including subjects in mathematics and computer science.
- Grading homework assignments and exams, preparing course materials and holding mentoring hours with undergraduate students.

OTHER PROJECTS

• **Estimating beatmap difficulty in osu! rhythm game**

Designing and testing an unofficial algorithm to compute the difficulty of beatmaps in a rhythm game called “osu!”. Also writing a discord bot in python to recommend beatmaps to players based on the type of maps they usually like to play.

Github: https://github.com/Pot1a1995/POT_Bot

• **Translating Light Novel from Japanese to English**

Translated Volume 3 of a light novel (as a fan) named “Real na Kanojo nante Irimasen!” (English: “I don’t need a real girlfriend!”) from Japanese to English. Also built the webpage hosting the translations from scratch using Bootstrap, CSS, mdbook, and Travis CI.

Web: <https://pot1a1995.github.io/>

LANGUAGES
SPOKEN

- Bengali (Native)
- English (Bilingual proficiency)
- Hindi (Conversational)
- Japanese (Conversational)

PUBLICATIONS

- D. Banerjee, S. Mukherjee, *Neuberg Locus and its Properties*, J. Classical Geometry, Volume **2** (2013), 26–38. (pdf)
- S. Mukherjee, D. Ghosh, R.K. De, *Expected Return Time to the Initial State for Biochemical Systems with Linear Cyclic Reactions: Unidirectional and Bidirectional*, Sadhana, Volume **44** (2019), 03. (pdf)
- D. Mubayi, S. Mukherjee, *Triangles in graphs without bipartite suspensions*, submitted (2020). (pdf)
- X. Liu, S. Mukherjee, *A new stability theorem for the expansion of cliques*, submitted (2020). (pdf)
- D. Mubayi, S. Mukherjee, *Maximum \mathcal{H} -free Subgraphs*, Journal of Combinatorics, Volume **12 (2)** (2021). (pdf)
- S. Mukherjee, *Turán Numbers of Hypergraph Suspensions of Even Cycles*, submitted (2021). (pdf)
- S. Mukherjee, S. Mukherjee, B.S. Hua, N. Umetani, D. Meister, *Neural Sequence Transform*, Computer Graphis Forum, Volume **40 (7)** (2021). (pdf)

- S. Mukherjee, *Extremal Problems for Graphs and Hypergraphs*, University of Illinois at Chicago, Thesis (2021). (pdf)
- S. Mukherjee, *A Grover search-based algorithm for the list coloring problem*, IEEE Transactions on Quantum Engineering, Volume **3** (2022). (pdf)
- X. Liu, S. Mukherjee, *Tight query complexity bounds for learning graph partitions*, accepted, Conference on Learning Theory (2022). (pdf)