

# Sayan Mukherjee

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CONTACT INFORMATION	Ph.D. Candidate, Mathematical Computer Science, Department of Math., Stat., and CS University of Illinois at Chicago Chicago, IL 60607	<a href="http://homepages.math.uic.edu/~potla/">http://homepages.math.uic.edu/~potla/</a> Email: <a href="mailto:smukhe2@uic.edu">smukhe2@uic.edu</a> LinkedIn: <a href="#">sayanmukherjee1995</a> Github: <a href="#">Potla1995</a> DOB: October 21, 1995
	<b>Thesis Advisor:</b> Dhruv Mubayi	<b>Expected Graduation:</b> May 2021
RESEARCH AREA	Extremal Combinatorics and Graph Theory	
EDUCATION	<b>Indian Statistical Institute, Bangalore Center</b> Bachelor of Mathematics, 2013–2016	
LANGUAGES	English, Bengali, Hindi, and Japanese.	
SKILLS	<ul style="list-style-type: none"><li>• Experienced in C++, Python, sage.</li><li>• Proficient in Algorithms, Graph Theory and Combinatorial Optimization.</li><li>• Experienced in Quantum Algorithms.</li></ul>	
WORK AND RESEARCH EXPERIENCE	June–August 2020	<b>Quantum Computing Internship</b> <i>Company Name:</i> Elyah <i>Location:</i> Remote <ul style="list-style-type: none"><li>- Designed and implemented quantum algorithms solving problems with real life applications using Grover Search.</li><li>- Coded in qiskit, pyquil and braket-sdk, and tested said algorithms on both simulators and quantum computers.</li></ul>
	July 2019	<b>Polynomial Methods in Combinatorics</b> <i>Workshop Lecturers:</i> Adam Sheffer, Joshua Zahl <i>Location:</i> University of California, Berkeley. <ul style="list-style-type: none"><li>- Attended Summer Graduate School at the Mathematical Sciences Research Center via recommendation by the UIC Math department.</li><li>- Studied applications of the polynomial method in combinatorics and analysis, and attended daily collaborative problem solving sessions.</li></ul>
	June 2018	<b>SIAM Conference on Discrete Mathematics</b> <i>Organizer:</i> Society for Industrial and Applied Mathematics <i>Location:</i> University of Colorado, Denver. <ul style="list-style-type: none"><li>- Attended conference talks on the most recent advances in discrete mathematics, delivered by experts as well as graduate students working on the field.</li></ul>
	June 2017	<b>Random Graphs and Probabilistic Methods</b> <i>Workshop Lecturers:</i> Dimitris Achlioptas, Louigi Addario-Berry, Andrzej Rucinski, Lutz Warnke <i>Location:</i> University of Toronto <ul style="list-style-type: none"><li>- Attended Summer Graduate School at the Fields Institute for Research in Mathematical Sciences through a competitive selection procedure.</li><li>- Learned several recent techniques in random graphs and probabilistic methods via lectures and problem sessions organized at the summer school.</li></ul>

- 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.

HONORS AND  
AWARDS

- 2016 **Merit Award, Fall 2016, UIC**  
 (Based on academic performance and MS exam)
- 2013–2016 **KVPY Fellowship from Govt. of India**  
 (Rank: 100 (India), Qualified for BS at Indian Institute of Sciences)
- 2011 **Sharygin Geometry Olympiad, online correspondence round**  
 (Rank: 4 (intl.), score: 53/63)
- 2011–2013 **Indian National Mathematical Olympiad**  
 (Merit Certificate Holder for 2012 and 2013)

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, *Maximum  $\mathcal{H}$ -free Subgraphs*, accepted, Journal of Combinatorics (2020). (pdf)
- D. Mubayi, S. Mukherjee, *Triangles in graphs without bipartite suspensions*, preprint (2020). (pdf)
- X. Liu, S. Mukherjee, *A new stability theorem for the expansion of cliques*, preprint (2020). (pdf)
- S. Mukherjee, *Turán Numbers of Hypergraph Suspensions of Even Cycles*, preprint (2020). (pdf)

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
Spring	2021	Teaching Assistant, Calculus for Life Sciences

- Duties**
- Lead and instruct over twenty different discussion sessions of 20-25 students each, including the following subjects: Linear Algebra, Graph Theory, Introduction to Python, Introduction to Data Structures, Computer Algorithms, Codes and Cryptography.
  - Grading homework assignments and exams, preparing course materials and holding mentoring hours with undergraduate students.

PRESENTATIONS  
AND TALKS

2021	<b>Turán Numbers of Hypergraph Suspensions of Even Cycles</b> Invited Speaker, 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.
2020	<b>Learning Circuits using Value Injection Queries</b> 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.
2019	<b>Spectral Partitioning of Random Graphs</b> 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.
2019	<b>An Invitation to Combinatorics</b> 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.
2018	<b>Analyzing Growth of an Extremal Function for Hypergraphs</b> Graduate Combinatorics/ Math and CS Seminar, UIC Presented research leading to the paper titled <i>On Maximum <math>\mathcal{H}</math>-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.
2018	<b>An introduction to the Turán problem on graphs</b> 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.
2017	<b>The emergence of linearly sized paths in the “supercritical regime” for the random graph <math>G(n, p)</math></b> 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.

## CURRENT 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/Potla1995/POT\\_Bot](https://github.com/Potla1995/POT_Bot)

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

Currently translating a light novel (as a fan) named “Chuuko demo Koi ga Shitai!” (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://potla1995.github.io/Chuuko-demo-Koi-ga-Shitai/>