Devansh **Shringi**

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Education

University of Toronto — *Toronto, Canada*

Ph.D. in Computer Science — *Sept. 2022-Present*

- **GPA - NA** Supervisor- **Prof. Shubhangi Saraf**

Indian Institute of Technology, Kanpur — *Kanpur, India*

Dual BT-MT in Computer Science and Engineering — *Jul 2017 - May 2022*

- **M. Tech CPI - 10.0/10.0** Supervisor- **Prof. Nitin Saxena**
- **B. Tech CPI - 9.7/10.0**

Research Interests

Computational Complexity Theory, Pseudorandomness, Computational Algebra, Algebraic Complexity

Publications

On the Multilinear Complexity of Associative Algebras

Markus Bläser,Hendrik Mayer, **Devansh Shringi** — *September 2022*

- Submitted

Explicit Construction of Local Ramanujan Graphs of q+1 degree for almost all prime power q — *[paper]*

Rishabh Batra, Nitin Saxena, **Devansh Shringi** — *May 2022*

- Accepted in Journal of Computational Complexity

Research Experience

Construction of Local Ramanujan Graphs and Testing Algebraic Independence(Master Thesis) — *[paper]*

Advisor:Prof. Nitin Saxena, Indian Institute of Technology Kanpur — *Jan. 2021 - May 2022*

- Worked on localizing the known constructions of Ramanujan Graphs of degree prime power+1
- Learnt about the constructions of Ramanujan graphs, Cayley graphs, local expanders and local Ramanujan graphs of degree 3
- Localized the construction by Morgernstern of infinite families of $O(\log q)$ locality $q+1$ regular bipartite Ramanujan graphs, thereby extending known local constructions to degrees $q+1$ for $q=p^k$, p is prime
- Also worked on developing an efficient algorithm to test Algebraic Independence of small degree polynomials over small characteristic fields

Lower bounds Multilinear Complexity on various Algebras — *Saarbrucken, Germany*

Advisor:Prof. Markus Bläser, Saarland University — *May 2022 - Present*

- Worked on generalizing Alder-Strassen Bound from Bilinear to Multilinear complexity
- Obtained exponential lower bounds for cases when algebra is product of Matrix algebras with elements from a division algebra
- Extended the exponential lower bound to general Non-commutative Algebras

Sparse Polynomial Identity Testing using less Random bits — *(remote)[report]*

Advisor:Prof. Markus Bläser, Saarland University — *Mar. 2021 - Dec. 2021*

- Worked on decreasing the number of random bits required for Blackbox Polynomial Identity Testing(PIT) for Sparse polynomial
- Learnt about concepts like testers, Sidon sets, Isolation lemma and their application in blackbox PIT
- Used Descartes' Rule of sign to create a Hitting set for sparse polynomial of size $O(n^2 \cdot m^{3.73})$ where m is number of monomials
- Working on using it to get a randomized algorithm using only $O(\log(m))$ random bits

Polynomial Identity Testing for Depth4 Circuits O(1) Top & Bottom Fan-in (UG project) — *[report1][report2]*

Advisor: Prof. Nitin Saxena, Indian Institute of Technology Kanpur — *Jan. 2020 - Nov. 2020*

- Studied about the work done on the problem of PIT for the case of constant top fan-in depth3 and depth 4(constant bottom fan-in) circuits using Sylvester Gallai approach. Also, studied various results on constant top fan-in problem for depth3 circuits.
- Explored an approach to extend the ideal membership approach for depth3 circuits to depth4 using Gröbner's basis and F5 algorithm.
- Worked on extending the work of Shpilka and Peleg of Top fan-in 2 Bottom fan-in 2 from to Top fan-in 2 Bottom fan-in 3
- Created structure theorem for cubics lying in radical generated by 2 cubics that is equivalent to structure theorem by Shpilka for quadratics.

Lower bounds for Graph Streaming Algorithms with constant passes *[report]*

Advisor: Prof. Raghunath Tewari, Indian Institute of Technology Kanpur *Jan. 2021 - Apr. 2021*

- Read the literature on lower bounds of streaming algorithm
- Learnt about reduction of problem to set Intersection lower bounds, and various tools for it like Unique reach problem and Ruzsa-Szemeredi Graphs, as well as finding lower bounds for set-intersection problem
- Worked on extending the near quadratic lower bound of 2 pass streaming algorithm to for 3 pass and beyond
- Created a 3 player communication game that worked for 3 pass algorithm. Also, attempted various designs to create worst case distribution.

Talks

Derandomizing PIT Means Proving Circuit Lower Bounds *Nov. 2020*

Course: Computational Complexity Theory *[Slides]*

Polynomial Identity Testing of Depth 4 Constant Top and Bottom Fanin *Nov. 2019*

Special Interest Group on Theoretical Aspects of Computer Science, SIGTACS, IITK *[Abstract]*

Introduction to Theoretical Computer Science *Sep. 2019*

Computer Science Freshers(ACA), IITK *[Slides]*

Teaching Experience

Teaching Assistant, CSC304:Algorithmic Game Theory and Mechanism Design *University of Toronto*

Instructor: Prof. Nisarg Shah *Sep. 2022 - Dec. 2022*

Teaching Assistant, CS203: Probability for Computer Science *IIT Kanpur*

Instructor: Prof. Rajat Mittal *Mar. 2022 - Apr. 2022*

Teaching Assistant, CS202: Logic *IIT Kanpur*

Instructor: Prof. Subhajit Roy *Jan. 2021 - Mar. 2021*

Teaching Assistant, CS345: Algorithms II *IIT Kanpur*

Instructor: Prof. Surender Baswana *Jul. 2021 - Nov. 2021*

Tutor, ESC101: Fundamentals of Computing *IIT Kanpur*

Instructor: Prof. Debadatta Mishra and Prof. Swarnendu Biswas *Feb. 2021 - Jun. 2021*

Tutor, ESC101: Fundamentals of Computing *IIT Kanpur*

Instructor: Prof. Biswabandan Panda *Oct. 2020 - Feb. 2021*

Honors & Awards

2022	**Research Fellow**, Max Planck Institute for Informatics
2022	**Proficiency Medal(Best Master Thesis in Computer Science)**, Convocation 2022, IIT Kanpur
2018-22	**5 consecutive Academic Excellence Awards**, Indian Institute of Technology, Kanpur
2020	**DAAD-WISE scholarship**, for research in Summer 2020(Redacted due to COVID)
2017-21	**Exceptional Performances in 7 courses**, Indian Institute of Technology, Kanpur
2017	**AIR 179 JEE Advance**, out of 200,000 candidates
2017	**AIR 52 JEE Main**, out of 1.2 million candidates
2017	**Qualified INChO, INPhO, INAO**, Top 35 in each field(Chemistry,Physics,Astronomy) in all of India
2016	**Bronze Medal at IOAA 2016**, representing India
2016	**AIR 88 KVPY Scholarship**, out of 100,000 candidates
2016	**Qualified INMO, INAO**, Top 35 in all of India

Other Professional Activities

Sub-Reviewer

FOCS 22 *Apr. 2022 - May 2022*

- Reviewed a paper under guidance of Prof. Nitin Saxena

Sub-Reviewer

SIAM Journal of Computing(SICOMP) *Jan. 2022 - Feb. 2022*

- Reviewed a paper under guidance of Prof. Nitin Saxena

Reviewer

38th International Symposium on Computational Geometry (SoCG 2022) *Dec. 2021 - Jan. 2022*

- Reviewed a paper to appear in SoCG as a part of Computational Geometry Week 22

Coordinator, Association of Computing Activities (ACA)

Indian Institute of Technology, Kanpur *Aug. 2019 - Dec. 2020*

- Conducted various events like Happy hours, Freshers and Farewell of CS Department promoting interaction among Department members
- Also organized introductory projects in Computer Science for First year Undergraduate students

Project Mentor

ACA, CSE IITK *Jan. 2019 - May 2020*

Mentored a group of First Year Students introducing them to various aspects of Theoretical Computer Science

Student Guide

Counselling Service, IITK *Jul. 2018 - Apr. 2019*

Helped a group of 6 First year Students get familiar in campus and conducted their orientation as their guide.

Graduate Courses

Arithmetic Circuit Complexity,
Randomized Methods in Computational Complexity,
Computational Number Theory and Algebra,
Special Topics in Computer Science Engineering,
Topics in Error-Correcting Codes,
Quantum Computing*,
Modern Cryptology,
Randomized Algorithms,
Graphs, Matrices and Optimization
Computational Complexity Theory,
Algorithmic Information Theory,
Intro to ML*

**-Exceptional Performance*
#-Ongoing