Tushant Mittal

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EDUCATION

Indian Institute of Technology Kanpur, Uttar Pradesh, India — Jul 2014 – Present

- B.Tech. in Computer Science and Engineering, $9.3/10.0$ (After 7 semesters)

FIITJEE, Hyderabad, Telangana, India — May 2014

- Board of Intermediate Education, 96.9%

Bharatiya Vidya Bhavan's Public School, Hyderabad, Telangana, India — Apr 2012

- Central Board of Secondary Education (CBSE), $10.0/10.0$

RESEARCH INTERESTS

- Cryptography
- Computational Complexity
- Computational Number Theory and Algebra

PUBLICATIONS

Matilde Lalín and **Tushant Mittal**. The mahler measure for arbitrary tori. Research in Number Theory, 4(2):16, Mar 2018 Link

RESEARCH EXPERIENCE

Algebraic Independence — Aug 2017 – Dec 2017

Under Prof. Nitin Saxena, IIT Kanpur Report

- Studied the computational problem of testing algebraic independence of a set of multivariate polynomials over fields of small characteristic.
- Proved a new criterion which relates dependence of polynomials with ideal membership of a non trivial linear combination of their shifted polynomials.
- Also explored a new method of dimension reduction to univariates.

Mahler Measure — May 2017 – Jul 2017

Under Prof. Matilde Lalin, Université de Montréal Link

- Studied the Mahler measure of a particular polynomial and the elliptic curve given by its Weierstrass form.
- Proved Boyd's Conjecture which was a relation between their Mahler measures and L-function values.
- Generalized the relation to a variation of Mahler measure where the defining integral is performed over a more general torus instead of the unit torus.
- Work published in Research in Number Theory, Springer.

Algebraic Geometry — May 2016 – Jul 2016

Under Prof. Kapil Paranjape, IISER Mohali Report

- Learned commutative algebra and covered the basics of algebraic geometry.
- Explored different aspects of algebraic geometry such as classical, computational, enumerative and projective algebraic geometry and also learnt about Gröbner basis, Schläfli's Double Six.
- Rediscovered Kleiman and Laksov's elementary proof of Grassmannian is a projective variety using linear algebra and algebraic geometry which is more accessible than the traditional proofs.

PROJECTS

Sheaf Cohomology — Jan 2018 – Apr 2018

Course Project for Sheaves and Topos Theory, taken by Prof. Amit Kuber Report

- Read the basic theory of sheaf cohomology, made a report and presented it.

Categorical Complexity — Sep 2017 – Dec 2017

Course Project for Category Theory, taken by Prof. Amit Kuber Report

- Read and presented the paper Categorical Complexity by Saugata Basu, Umut Isik.
- The paper attempts to unify the various models of complexity by defining the notion of complexity of categorical objects like functors and diagrams

Adversarial ML — Aug 2017 – Nov 2017

Course Project for Machine Learning, taken by Prof. Purushottam Kar Report

- Studied and implemented the method of crafting adversarial inputs, specifically for Google's Inception V3 CNN

Cryptanalysis — Jan 2017 – Apr 2017

Course Project for Modern Cryptology, taken by Prof. Manindra Agrawal

- Designed and coded differential cryptanalysis attacks for various encryption schemes such as a 6 round DES, RSA with small public exponent using Coppersmith algorithm , 4 round AES

C++-Compiler Jan 2017 – Apr 2017
Course Project for Compiler Design, taken by Prof. Amey Karkare

- Implemented an end-to-end compiler for C++, written in Python

NachOS Aug 2016 – Nov 2016
Course Project for Operating Systems, taken by Prof. Mainak Chaudhuri

- Implemented various system calls, scheduling algorithms and comparatively evaluated their performance

SELECTED TALKS

Computational lens - 2008 Recession, Evolution and Anarchy Mar 2016
Last talk given in Science Coffeehouse, IITK

Algebraic Independence - I,II Oct 2017
Series of two talks given in SIGTACS, IITK *Slides*

Gröbner Basis Apr 2017
Course Project for Computational Number Theory and Algebra, taken by Prof. Nitin Saxena *Slides*

Democracy's Impossible - Arrow's Theorem Mar 2016
Talk given in Science Coffeehouse, IITK

Information Theory Nov 2015
Course Project for Discrete Mathematics, taken by Prof. Rajat Mittal *Report*

Cutting a Cake - Monsky's Theorem Oct 2015
Talk given in Science Coffeehouse, IITK

Sperner's Lemma Aug 2015
2^{nd} *prize in the intra-college SciTalk competition*

ACADEMIC ACHIEVEMENTS

- **MITACS Globalink Research Internship** 2017
- **Summer Research Fellowship Programme, Indian Academy of Science** 2016
- **Joint Entrance Examination (JEE Advanced)** , Rank 186 / 1,20,000 2014
- **KVPY National Fellowship, DST, Government of India** 2014

GRADUATE COURSES

- Approximation Algorithms
- Computational Complexity
- Modern Cryptology
- Randomized Algorithms
- Sheaves and Topos Theory
- Category Theory
- Elliptic Curves and Applications
- Computational Number Theory and Algebra

TEACHING EXPERIENCE

Tutor - Fundamentals of Computing

- Selected as one among 12 tutors for the introductory programming course with 450 students.
- Taught weekly tutorial lectures, supervised the lab practice sessions and graded students .
- Also had the responsibility of designing questions for lab assignments, midterm and endterm exams.

Volunteer Teacher, Shiksha Sopan, IITK

- Volunteered with Shiksha Sopan, an NGO aimed at providing education to economically weaker section of the society.
- Taught mathematics at a primary government school in the nearby Bara Sirohi village.

EXTRA CURRICULAR

Quizzing

- An avid quizzer, I have participated and won at many intra-college quizzes and inter-school competitions.
- Managed the Quiz Club, IITK's affairs as the Secretary in 2015-16 and as the Coordinator in 2016-17.

Science Talks

- I also love giving/attending science talks and won the **second prize** in the Intra-College SciTalk Competition.
- Chosen as the **Leader**, Science Coffeehouse, IITK a hobby group where discussions and talks are held on a wide number of scientific topics, for the academic year 2016-17

Volunteer - FSTTCS'17

- Will be attending and also volunteering at *Foundations of Software Technology and Theoretical Computer Science* (FSCTTCS), 2017 to be held at IIT Kanpur

TECHNICAL SKILLS

- Languages : Sage, Mathematica, C/C++, Python, Octave, Bash, Verilog
- Web Development : HTML/CSS, PHP, SQL, Django,
- Utilities : LaTeX, GNUPlot, Git, SQLite