2015 MIT PRIMES CONFERENCE

Program for Research In Mathematics, Engineering, and Science for High School Students



Five tetrahedra in the regular dodecahedron. By Sheela Devadas PRIMES student in 2011-12 and the winner of the 2015 Alice T. Schafer Prize for excellence in mathematics by an undergraduate woman. Photo by Dennis Porche.

Saturday, May 16: Mathematics

8:30 am Welcoming remarks

Prof. Tomasz Mrowka, Head of the MIT Mathematics Department Prof. Pavel Etingof, PRIMES Chief Research Advisor Dr. Slava Gerovitch, PRIMES Program Director

9:00 am Session 1

Varun Jain, Circular planar graphs and electrical networks (mentor Carl Lian)

Alok Puranik, Limitations of semidefinite programming for certifying RIP (mentor Adrian Vladu)

Kavish Gandhi and Noah Golowich, Analysis of Boolean functions (mentor Yufei Zhao)

10:25 am Session 2

Dhruv Medarametla, Bounds on the norms of locally random matrices (mentor Aaron Potechin)

Karan Sarkar, On modular extensions to Nim (mentor Dr. Tanya Khovanova)

Caleb Ji, Robin Park, and Angela Song, Combinatorial games of no strategy (mentor Dr. Tanya Khovanova)

11:45 am Session 3: PRIMES-IGL

Mehtaab Sawhney, A study of bar and arc k-visibility graphs (mentor Jonathan Weed)

Richard Yi, Continuous model for two-lane traffic flow (mentor Prof. Gabriele LaNave, University of Illinois at Urbana-Champaign)

Daniel Guo, An infection spreading model on trees (mentor Prof. Partha Dey, University of Illinois at Urbana-Champaign)

1:45 pm Session 4
Girishvar Venkat, Signatures of the contravariant form on Specht modules for cyclotomic Hecke algebras (mentor Siddharth Venkatesh)

Samuel Rush, Signatures in representations of rational Cherednik algebras (mentor Gus Lonergan)

Luke Sciarappa, Algebras in representations of the symmetric group S, when t is transcendental (mentor Nate Harman)

3:00 pm Session 5

Brandon Epstein, The defect angle and the relation to the Laplacian matrix (mentor Prof. Martin Rocek, SUNY at Stony Brook)
Rachel Zhang, Statistics of intersections of curves on surfaces (mentor Prof. Moira Chas, SUNY at Stony Brook)

Arthur Azvolinsky, Explicit computations of the frozen boundaries of rhombus tilings (mentor Alisa Knizel)

4:15 pm <u>Session 6</u>

Meena Jagadeesan, The exchange graphs of maximal weakly separated collections (mentor Miriam Farber)

Meghal Gupta, Extremal functions of forbidden matrices (mentor Jesse Geneson)

David Amirault, Better bounds on the rate of non-witnesses of Lucas pseudoprimes (mentor David Corwin)

5:25 pm <u>Session 7</u>

Jacob Klegar, Tiling-harmonic functions (mentor Prof. Sergiy Merenkov, CCNY-CUNY)

Ahaan Rungta, Mathematically modeling the motion of cells in porous media (mentor Andrew Rzeznik)

Nick Diaco, A new coin weighing problem and concealing information (mentor Dr. Tanya Khovanova)

Sunday, May 17: Computer Science and Computational Biology

8:30 am Welcoming remarks

Prof. Srini Devadas, MIT Department of Electrical Engineering and Computer Science

Dr. Slava Gerovitch, PRIMES Program Director

8:45 am Session 8: Medical Informatics

Ashay Athalye, Machine learning characterization and prediction of intrinsically disordered protein interactions: A focus on BRCA1 (mentor Dr. Gil Alterovitz)

Arul Prasad. The significance of disordered residues in bacterial drug resistance and SNP interactions in relation to disease associations (mentor Dr. Gil Alterovitz)

Kara Luo, Computer simulation of biosynthetic drug modifications to improve binding activity (mentor Dr. Gil Alterovitz)

10:00 am Session 9: Medical Informatics and Computational Biology

Andrew Li, Exploring multi-conformational modeling and flexibility of molecular recognition features in improving drug docking (mentor Dr. Gil Alterovitz)

Daniel Lu, Investigating drug synergy mechanisms of disordered protein-related diseases (mentor Dr. Gil Alterovitz)

Laura Braverman and Betsy Pu, Genomic and epigenomic signatures of chromosomal domains (mentors Maxim Imakaev and Boryana Doyle)

11:15 pm Session 10: Computer Science

Amy Chou and Justin Kaashoek, Automating generation of programming problems (mentor Rohit Singh)

Harshal Sheth and Aashish Welling, A garbage collected network stack with CSP threads (mentor Cody Cutler)

Gregory Barboy, Albert Gerovitch, and Andrew Gritsevskiy, Mobile health surveillance: The development of software tools for monitoring the spread of disease (mentor Dr. Natasha Markuzon, Draper Lab)

1:30 pm Session 11: Computational Biology

Michael Colavita, Clustering of pathogenic genes in human coregulatory network (mentor Soheil Feizi)

Allison Paul, The inference of directed acyclic graphs using spectral clustering (mentor Soheil Feizi)

Lalita Devadas, Modelling changes in gene expression using five histone modifications (mentor Angela Yen)

2:45 pm Session 12: Computer Science

Diana Ding and Cristian Gutu, SecretRoom: An anonymous chat client (mentor Albert Kwon)

Akiva Gordon and Krishna Suraj, Improving oblivious RAM protocol through novel eviction and access strategies (mentor Ling Ren)

Henry Liu and Ethan Zou, Time traveling in multicore processors (ment

4:15 pm Session 13: Mathematics

Uma Roy, Infinity crystals for certain generalized quantum groups (mentor Seth Shelley-Abrahamson)

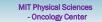
Niket Gowravaram, XYX Algebras (mentor Dr. Tanya Khovanova) Eric Nie, Dual Schubert polynomials (mentor Pavel Galashin)

5:25 pm Session 14: Mathematics

Kenz Kallal, Matt Lipman, and Felix Wang, Equal compositions of rational functions (mentor Thao Thi Thu Do and Prof. Michael Zieve)

Arjun Khandelwal and Joshua Xiong, Linear algebra methods in combinatorics (mentor Chiheon Kim)



















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