



Raising a Mathematician Foundation

Regn. No. E/8816 Thane Region
Registered under
Bombay Trust Act, 1950

A brief report on

Raising a Mathematician (Online) Training Program 2020

organized by

Raising a Mathematician Foundation

in association with

Chennai Mathematical Institute

from 10th – 16th May 2020





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Objective of Raising a Mathematician Training Program (RAM TP)

To search and mentor young mathematical talent (age group 13-15) in the country. Guide them to hone their skills and thinking by giving them the right tools, and create a research-mentality in mathematics.

Selection Procedure

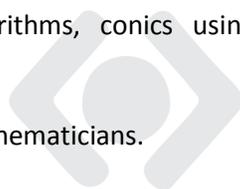
Out of more than 700 applications that were received from fifteen states across India, 140 applications were selected. The selection procedure was based on Students' Application Form, Teacher's Recommendation Form and Parent Questionnaire through which the participant's inclination towards mathematics and their career objectives were assessed.

Program Schedule and Pedagogy

Due to the unfortunate event of Covid 19 pandemic, RAM TP 2020 was conducted in an Online mode and not in the campus of Chennai Mathematical Institute (CMI) as planned earlier. The students were divided into 4 batches - A, B, C & D, with Batch D comprising of the most advanced students. A normal day in RAM TP this year for Batches A, B & C would consist of 2-3 sessions by the in-house faculty, each of 90 minutes duration, 1-2 guest speaker sessions, covering diverse areas in mathematics followed by a doubts clearing session towards the end of the day. The sessions were interactive in nature rather than the normal teaching method adopted in most classrooms. The participants were encouraged to ask questions and analyze the reason behind every statement and proof. The students derived different formulae and were excited to discover something new based on what they had learnt. It could be observed that the children loved the idea of discovering and proving things which they had not done earlier. Feedback from the students who were already getting extra-coaching for competitive exams highlighted the lack of focus on understanding the rationale behind the results they were applying to arrive at solutions while they were otherwise coached. One of the ideas of RAM TP was to break the exam-oriented learning and to encourage students to understand the concepts. In short, the objective was to enable them to discover knowledge rather than impart information to them!

Topics Covered for Batch A, B & C

- Euclidean and non-Euclidean geometry, number theory, linear and quadratic indeterminate equations, cryptography, algorithmic game theory, proofs, correlation and regression, permutations and combinations, popular matching algorithms, conics using geometry, mathematical logic, theory construction.
- Discussions on the work of eminent mathematicians.
- History of Indian mathematics in today's context and scope for further research.





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Topics Covered for Batch D

Delving into the depths of graduate level topics, the courses for the senior batch of RAM TP 2020 served as a stepping stone for students to explore interdisciplinary fields and dive deep into related areas. At the boundary of pure mathematics, statistics, and economics, regression analysis and causal inference are usually introduced at the graduate school. Along with acting as the cornerstone for modern-day, rapidly developing fields like Artificial Intelligence (AI) and Machine Learning (ML), these courses also help students to stay abreast with cutting-edge topics of scientific literature.

Regression analysis deals with data: estimating parameters for the population given the observations of a sample, fitting a hyper plane through a set of data points, and minimizing error to get the best possible predictions. On the other hand, causal inference is a blend of mathematical logic, probability and cause-effect relationships. The topic highlights the difference between scientific and statistical inference. Together, regression analysis and causal inference build the theoretical foundations for ever-more-important domains of AI (Artificial Intelligence) and ML (Machine Learning) which have spearheaded the data revolution. And we at RAM believe that giving young and talented learners a strong mathematical foundation on these topics will greatly influence their careers and academic interests.

Equipping students with these essential skills, helps open the gateway into the world of advanced science and technology and gives the students a great head start. In alignment with its purpose of spreading education beyond the confines of school syllabi, RAM foundation believes that these topics will enhance students' skill set and accelerate their learning curve. Identifying mathematically exceptional students from around the country, RAM TP gives the senior batch an opportunity to put their minds to use and explore advanced fields.

Invited speakers

The Chief Guest of the inaugural event, **Dr. Madhavan Mukund** (Dean of Chennai Mathematical Institute), inspired students by explaining about the importance of gifted-education programs and the various career and learning options involving mathematics.

The Chief Guest for the valedictory, **Dr. Ranjani Krishnan** from Michigan State University, motivated the students to fly high not only intellectually but also urged them to reach out and choose higher ideals in life.

Apart from lectures by in-house faculty, each day would witness an invited speaker. This year, there were remote sessions offered by many world renowned people, one of them being one of the top Econometrists - **Prof Jeffrey Wooldridge** on *Simpson's Paradox*. There were lectures by **Markus Joos**, an engineer from **CERN** on *Computing at CERN*, one by **Prof Damjan Kobal** (University of Ljubljana, Slovenia) on *Conics*. There were two sessions on discussions on Physics and Math - *Can you Physics a Math?*, between two world-class Physicists **Dr. Hariom Jani**, NUS (recipient of Arthur Nowick Student Award for Teaching and Silver Graduate Student Award for Research) and **Shyam Wuppuluri** (Einstein



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Fellow 2020 and Fellow of Royal Society of Arts, London). **Prof. Prajakta Nimbhorkar** from CMI gave a lecture on *Popular Matchings*. **Deven and Grayson** from the famous Art of Problem Solving (AoPS) portal shared their experiences with gifted math education, need for precocious students to have a peer group and some interesting problems and approaches to solve them.

Prof. Shripad Tambe (BSc Mathematics, IIT Bombay) took students through Cryptography.

R Hariharan (doctoral student at Michigan State University and Head of Academic Affairs, RAM Foundation) gave three plenary lectures (Important works of Euler, Varga Prakriti a.k.a. Pell's Equation, Cakravala algorithm to solve the Pell's equation).

Omkar Sambare shared different approaches to interesting problems like the Monty Hall Problem.

Three students from the alumni RAM TP, **Aadityan Ganesh** (undergrad at CMI), **Ashwat Jain** (12th grade student) and **Raghavendra Bhat** (freshman at University of Illinois Urbana Champaign) delivered lectures on *Algorithmic Game Theory*, *Fractals using Complex Numbers* and *Game of Primes*, respectively. Aadityan Ganesh also taught *Linear Algebra* for the Batch D students.

Pre and Post camp

Before the online camp, students went through pre-reading materials to equip themselves for the camp for about a month and worked on assignments related to them.

Usually after such programs participants are highly inspired but the inspiration dies out in due course of time. Raghavendra Bhat (alumni of RAM TP) has been doing sessions every weekend since May 2019 to a group of interested students thus creating a community of passionate learners. These sessions are done by him and occasionally by other ex-RAM TP students on a pro bono basis and they continue to inspire the younger students by creating sustained interest in the sessions.

Supporters of RAM TP 2020

CMI has been a big support in terms of outreach for RAM TP 2020. Dr. Hariom Jani, Mr. Vishnu Mujumdar (Institute of Advanced Research, Pune), Mr. Anirban Mukherjee (CEO of PAYU) and many other individuals (especially parents of RAM TP 2019 & 2020) have been kind enough to support RAM Foundation with their generous donations. RAM TP was backed by an enthusiastic and energetic band of volunteers who helped in all the operations.