

RAM TP 2021

REPORT



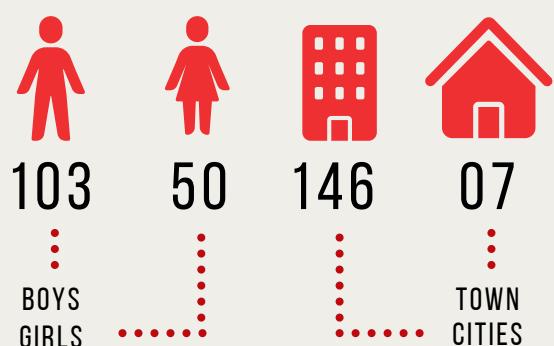
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KEY HIGHLIGHTS

Key highlights of
Raising A Mathematician Training
Program – 2021
(Event supported by NielsenIQ)

STUDENT DIVERSITY



KEYNOTE SPEAKERS



**GM
Vishwanathan
Anand**

Chess Grandmaster



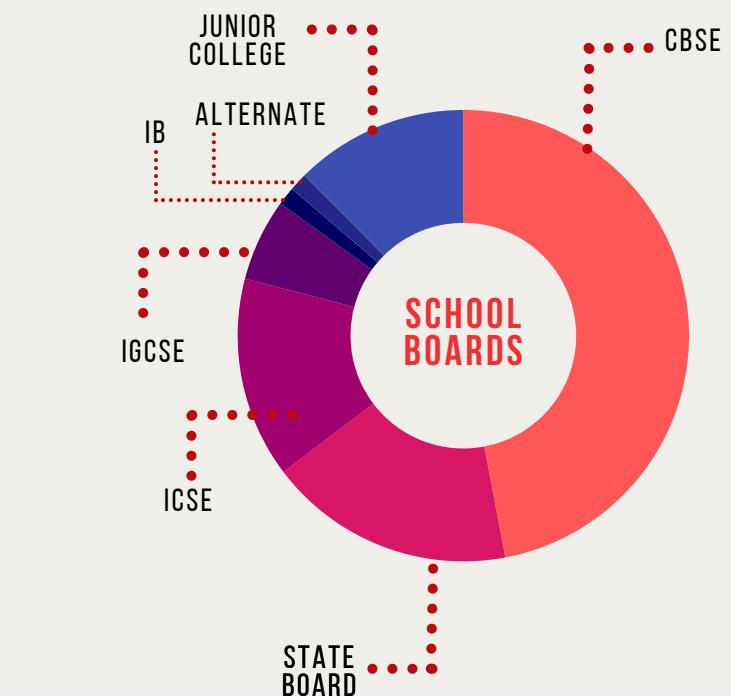
**Mr.
Lakshmi
Narayanan**

ex-vice chairman and
ex-CEO of Cognizant and
Chairman of ICT Academy

GRACED THE OCCASION WITH THEIR PRESENCE

**87 %
SELF ASSESSED**

87% of the participants' self-assessed substantial improvement in their understanding of subjects discussed in the course. Only 4.2% of participants rated their understanding of a subject as below satisfactory post the sessions.



**33 %
ACCEPTANCE RATE**

Student applications from 15 states in India, 33% were selected based on the rigorous process. Continued engagement and learning demonstrated by students attending the camp for 2 or more years



FACULTY

Eminent technical speakers from
4 countries across 3 continents
contributed and shared experiences.

DETAILED REPORT

Raising A Mathematician Training Program – 2021
(Event supported by NielsenIQ)

OBJECTIVE OF RAM TP

To search and mentor young mathematical talent (age group 13-15) in the country and 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 450 applications that were received from fifteen states across India, 155 applications were selected. The selection procedure was based on the Students' Application Form, Teacher's Recommendation form through which the participant's inclination towards mathematics and their career objectives were assessed.

PEDAGOGY AND PROGRAM SCHEDULE



Due to the unfortunate event of Covid 19 pandemic, RAM TP 2021 was conducted in an online mode like RAM TP 2020 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 C and D comprising the most advanced students. A normal day in RAM TP would consist of 3-4 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. 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 & D



For Batch A & B

These two batches of new students were exposed to a wide range of topics like Cryptography, Geometry, Proofs, Cryptography, Probability Puzzles, Origins of Risk in Mathematics, Transportation Problem, Kuttaka, Mathematical Thinking to avoid Logical Fallacies, Combinatorics & Music, Constructible numbers. The objective was to give them different flavours of mathematics right from pure to applied, and from the history of mathematics to logic. Novel topics like the evolution of binary mathematics through poetry, and how mathematical thinking can help in a world filled with fake news and hoax, etc. thrilled the students to see the broad spectrum of application of mathematics.

For Batch C

Functions and Functional Equations:

Classes started with the very foundations of the topic – relations and proceeded by giving the students of batch C, a very rigorous approach to functions. While basics are often underestimated, the importance of building a solid foundation was brought out in the classes. After building a solid base, the class moved on to solve questions on functional equations. Handpicked questions gave a taste of the different flavours involved in solving functional equations.



Group Theory:

Group theory is known for its vast and abstract nature. The class provided a beautiful introduction to group theory by building from familiar structures such as the integers and rotations, in order to build intuition for the subject as a whole. The basics of group theory, including various examples for groups, cyclic groups, abelian groups, order and Lagrange's theorem were covered in depth. The classes were exciting and definitely motivated students to explore group theory further. Homomorphism, isomorphism and the idea of quotient group and fundamental theorem of homomorphism were handled extensively. Also, results from number theory such as Bezout's theorem, Fermat's little theorem and its generalisation by Euler were proved using group theory.

For Batch D

The main focus for students in batch D was regression, a cornerstone for cutting-edge areas of research like machine learning (ML) and artificial intelligence (AI). Regression lies in the intersection of statistics, economics and pure math and is a graduate level course in various universities across the world. Along with Regression, Along with regression, Students were also taught causal inference, the study of cause and effect. The understanding of when one can conclude an action to be a cause of an event is tricky, and is not just important for an economist. It is a required skill for every student of natural sciences and certainly a required skill in the industry. Along with the two courses in economics, students were also introduced to abstract linear algebra. Linear algebra is a pre-requisite for regression, but rather than being restricted to the concrete parts of linear algebra required to support the regression course, students were also given a taste of abstraction that comes along with the pursuit of pure math.

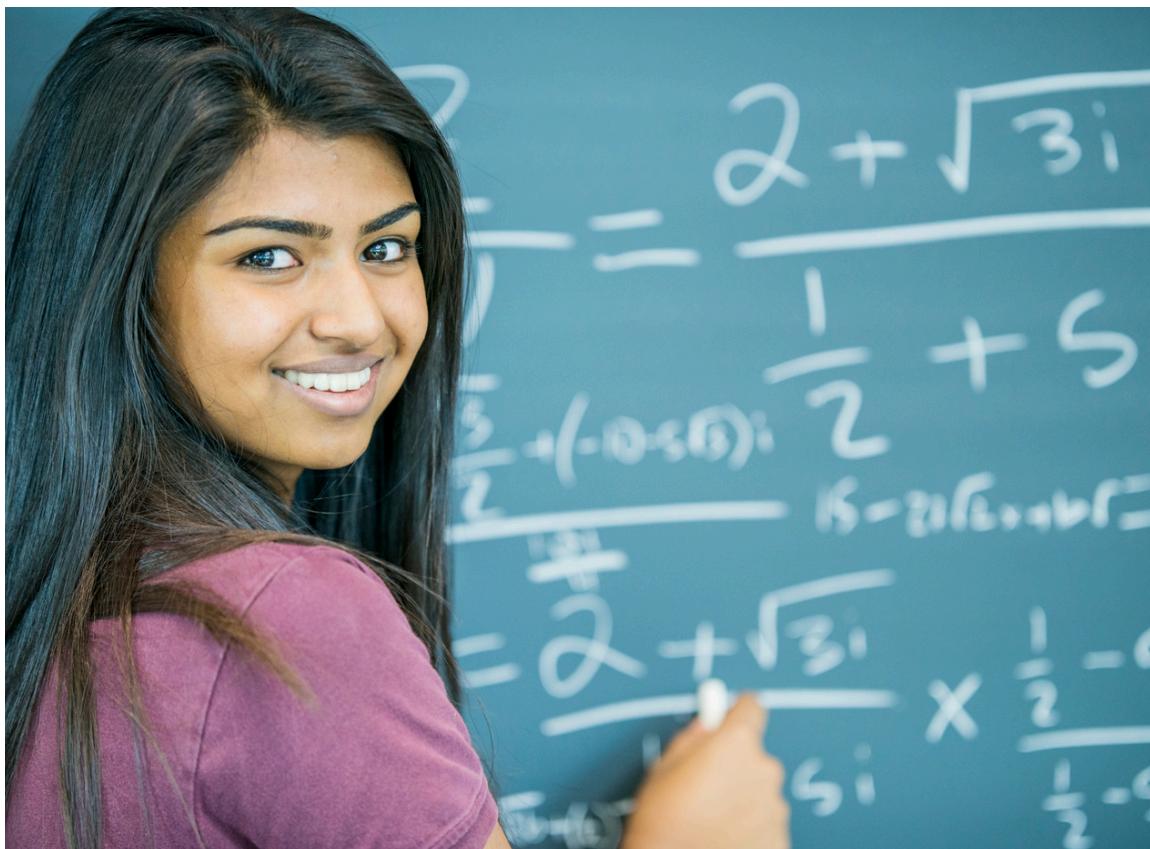
Regression analysis deals with data: estimating parameters for the population given the observations of a sample, fitting a hyper plane through a set of data points, and minimizing error to get the best possible predictions. On the other hand, causal inference is a blend of mathematical logic, probability 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 and ML 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.

Linear algebra, apart from acting as a central tool in the regression course, encouraged students to focus on the underlying structures which are helpful to work on problems at hand, rather than looking at the problem directly. This process is called abstraction. Abstraction is an essential skill a mathematician should possess in his/her tool kit. Even for the rest, the skill to focus on the essential parts of a problem rather than being carried away by all the complexity that accompanies the problem due to the area where it is applied is important. Linear algebra focussed on these abstractions. Theorems proved in this abstract world came in very handy while working with regression, allowing the students to understand the importance of linear algebra and the importance of the skill of abstraction.



Students from batches C and D attended a course on theory of matchings. The course was taken by Prof Prajakta Nimbhorkar from the Chennai Mathematical Institute, who has published multiple papers in top conferences in the same area. Matchings has been studied by both economists and computer scientists. Students were introduced to the computer scientists' viewpoint to get a flavour of theoretical computer science, an area that is not well known outside academic circles. Matchings and related areas in the intersection of economics and computer science has been absolutely relevant in the past decade, with two Nobel prizes in economics being awarded to this area recently (including the 2020 Nobel prize).

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.





SPEAKERS LINEUP

The sheer presence of the Chief Guest of the inaugural, **Chess Grandmaster**

Viswanathan Anand was an inspiration to the students. Mr Anand spoke eloquently on the importance of being introduced to the language of Chess and Math early. He spoke about his own love and passion for Mathematics and the students were amazed to hear that the grandmaster has a deep interest in Math and explores topics such as the Riemann zeta function!

The chief guest for the valedictory,

Mr. Lakshmi Narayanan, ex-vice chairman and ex-CEO of Cognizant and Chairman of ICT Academy stressed the importance of Math as the language of higher learning and research. As someone who reached the echelons of power in the industry, he highlighted the opportunities Mathematics provides not only in academia and research but also in the industry with jobs in emerging fields like Cryptography, Artificial Intelligence, Data Science etc.

There were sessions every day by in-house speakers as well as guest speakers.

GUEST SPEAKERS

Prof. Clemency Montelle

University of Canterbury, New Zealand

Highly sought-after historian of Mathematics, she extolled the beauty of Ancient Mathematics in a very highly interactive and interesting session. She beautifully showcased how language is also laced in Math



Prof. Reshma Menon

Harvard, USA

She gave a peek into how calculus is taught in Harvard. This was an inspiring session for both students and RAM Faculty.



Dr. Simon Rubinstein-Salzedo

Euler's Circle

The founder of Euler Circle, took a session on Take Away Games.



Prof. Atul Dixit

IIT Gandhinagar

He recently won the Gábor Szegő Prize 2021 from the Society of Industrial Applied Mathematics (SIAM), USA gave a lecture on Partitions.



Dr. Ajay Nerurkar

AI Scientist

Introduced the students of RAM TP 2021 to the realm of Bitcoins and took them through the math behind establishing and transacting with Bitcoins.



Prof. Jeffrey M. Wooldridge

Michigan State University, USA

He gave a talk on the very intriguing Birthday Problem.



Dr. Rajeeva Karandikar

Chennai Mathematical Institute

ex-Director – Chennai Mathematical Institute, took the students into the world of statistics through his lecture on Opinion polls.



Dr. S. Muralidharan

Retd. Computer Scientist from TCS, Chief Exam Coordinator for pre-Regional Mathematical Olympiad, gave lectures on Constructible numbers and Isometries.



Mr. Omkar Sambare

showed students the play of probability in Chess



Dr. Hariom Jani

National University of Singapore

Recipient of Arthur Nowick Student Award for Teaching and Silver Graduate Student Award for Research, inspired students with his talk on how to engage in Research in the area of Science.



IN-HOUSE FACULTY

Mr. Shriprasad Tambe



taught Cryptography and Group Theory

Mr. Vinay Nair



Co-founder of RAM

taught Proofs and Combinatorics in Music

Pallavi Patil



taught Kuttaka or Indian way of solving Linear Indeterminate Equations

Dr. R. Hariharan



Head of Academic Affairs, RAM Foundation

talked about 'Origins of Risks in Mathematics' and 'Mathematical Thinking to avoid Logical Fallacies'

Mr. Bhas Bhamre



Founder of Bhas Bhamre Academy

taught Functional Equations and Geometry

Prof. Prajakta Nimbhorkar



CMI

taught Algorithms and interesting problems in Computer Science

Mr. Yogesh Waikul



Co-founder of Vichar Vatika

took Transportation Problem and Optimisation

ALUMNI

OF RAM TP



Aadityan Ganesh

(undergrad at CMI)
Taught Linear Algebra for
the students of Batch D



Raghavendra Bhat

(Undergrad Student at
University of Illinois Urbana
Champaign)
Delivered lectures on
Rn Numbers



Ashwat Jain

(Freshman at
University of Oxford)
Delivered lectures on
Network flows & Fractals



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PRE & 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.

The students of RAM TP 2021 will continue to be engaged for three months post the camp through the extension of various topics covered during the program as well as an introduction to new topics.

SUPPORTERS OF RAM TP 2021

RAM TP 2021 was supported through the generous donation of time and money by both organisations and individual contributors. Special thanks to:



NielsenIQ is the business data analytics branch of the Nielsen Corporation, a global marketing research firm, with worldwide headquarters in New York City, United States. NielsenIQ retail and consumer data platforms measure shopper behaviours and emerging trends leveraging cutting edge analysis and data science to help businesses make concrete and decisive steps in their market strategy. One of Nielsen's best-known creations is the Nielsen ratings, an audience measurement system that measures television, radio and newspaper audiences in their respective media market.

Chennai Mathematical Institute (CMI)



For being our knowledge partner. Professors from Chennai Mathematical Institute, a centre of excellence for teaching and research, contributed immensely to RAM TP by serving as Faculty as well as by giving guest lectures. The students from CMI engaged with the RAM TP participants by volunteering as Teaching Assistants and also by participating in round table discussions. Through their work with RAM TP, CMI has inspired the next generation of students to engage more deeply in Mathematics.



Quolam Business Solutions

For building and maintaining our online student management software. Founded in 2015 by veterans from the IT Industry, Quolam is a digital age company that helps customers build quick and high impact digital experiences. Given their strength in blending analytical rigour with technology expertise, the Quolam team, built a custom student management system for RAM Foundation, that is now being used to track the student applications. The system has been helping RAM Foundation team track student progress and portfolio thus enabling us to design programs that will meet the needs of our diverse student group.

Parents of participants from RAM TP 2021. RAM TP was immensely supported by an enthusiastic band of volunteers 17 who were pivotal in ensuring the smooth operations of the camp.

GET IN TOUCH WITH US



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