MATH.BIZ 2023

REPORT

Raising A Mathematician Foundation™

Pravaha Foundation

Mahindra University

June 19th to 28th, 2023
Mahindra University, Hyderabad

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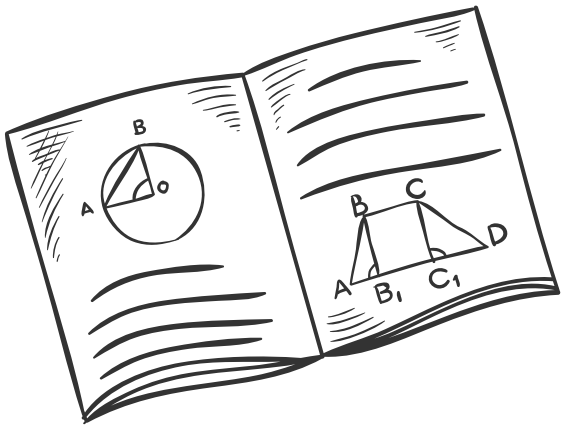

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ORGANISERS

"Math.Biz 2023" was a collaboration between Raising a Mathematician Foundation, Pravaha Foundation, and Mahindra University.

Raising A Mathematician Foundation

RAM is a not-for-profit organization that promotes mathematics education nationwide through various initiatives. From its flagship residential mathematics camp - 'Raising A Mathematician Training Program' (RAM TP) to annual camps like Epsilon India and All Girls Math Nurture Camp (AG MNC) and workshops on modules such as application of mathematics in finance, economics, computer science, and physics, RAM focuses on making mathematics appealing for gifted students and the general public.

Additionally, RAM offers Math Olympiad Training Programs that provide year-round training for students aiming to participate in the International Mathematical Olympiad. RAM also conducts Maths Circle for non-English medium school students in the suburbs of Mumbai which happens to be the first Maths Circle in India for non-English medium students.

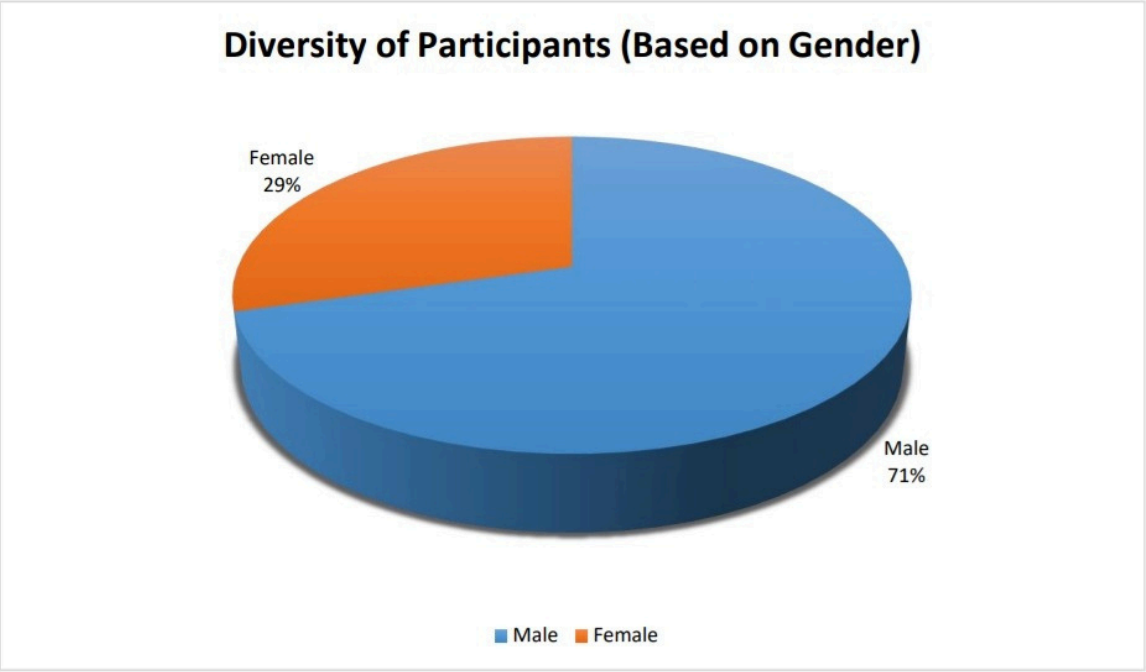
Pravaha Foundation

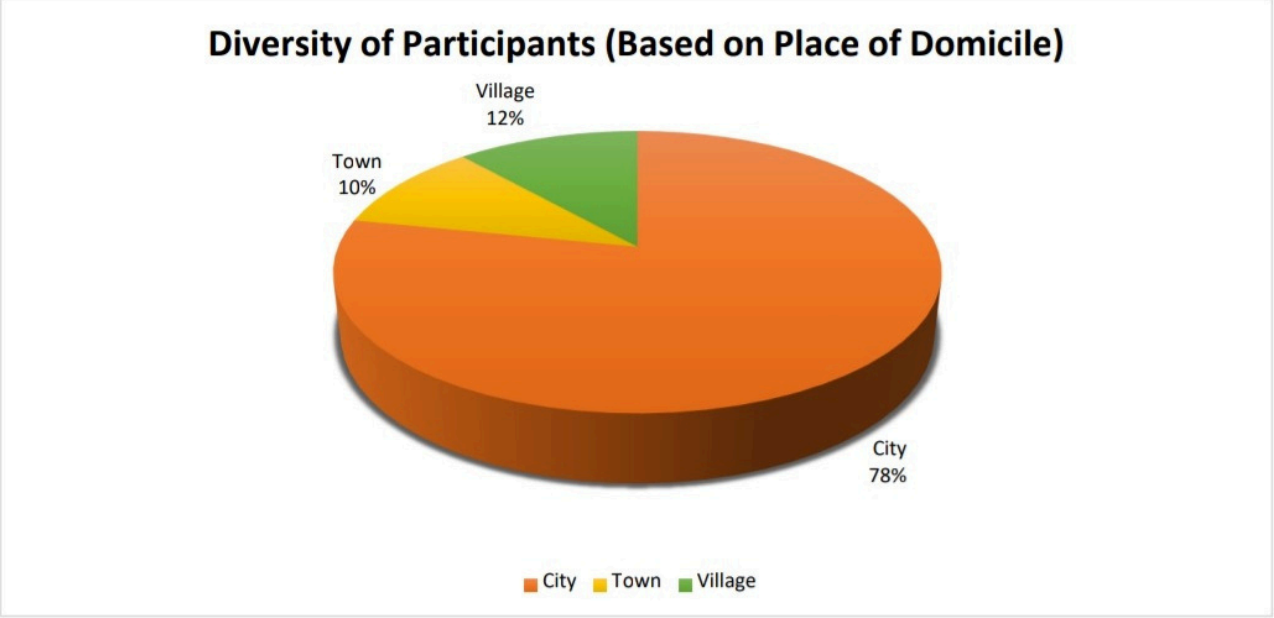
Pravaha Foundation is a non-profit organisation that aims to bring together multiple stakeholders to tackle development issues at scale. Pravaha's major focus in the long term includes poverty and inequality, education, social innovation, and children and young people. Pravaha's flagship program aims to advance high-ability and talent-related learning in India alongside leading education, social development, and policy and research partners.

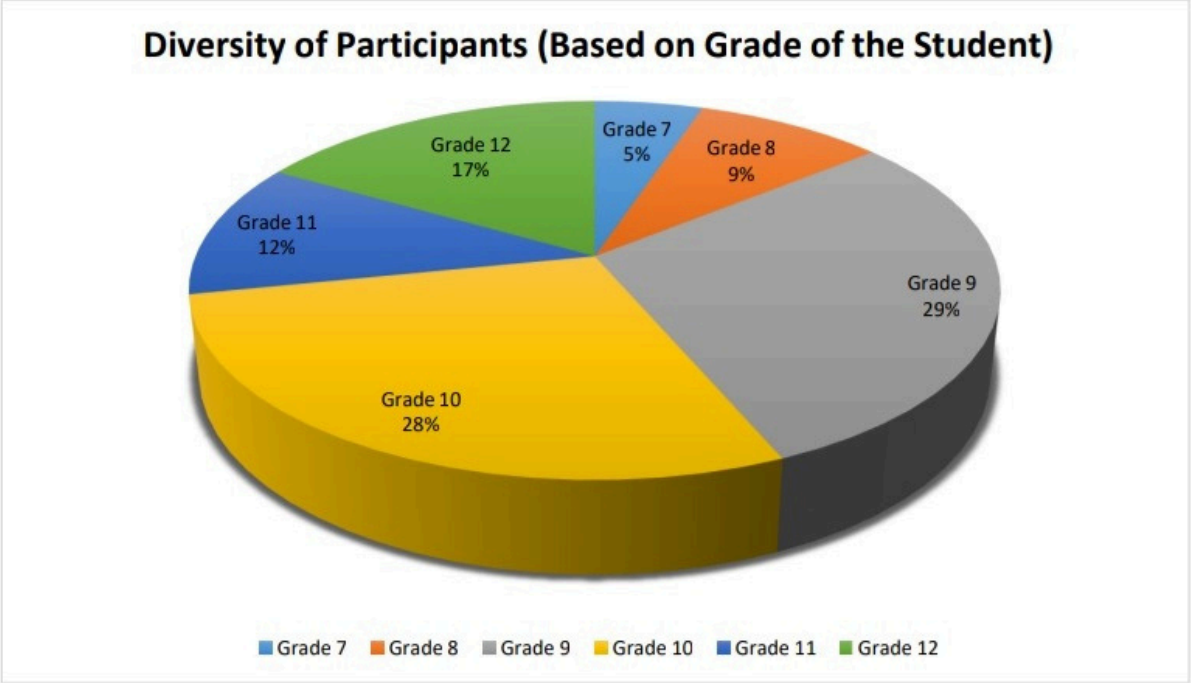
Mahindra University

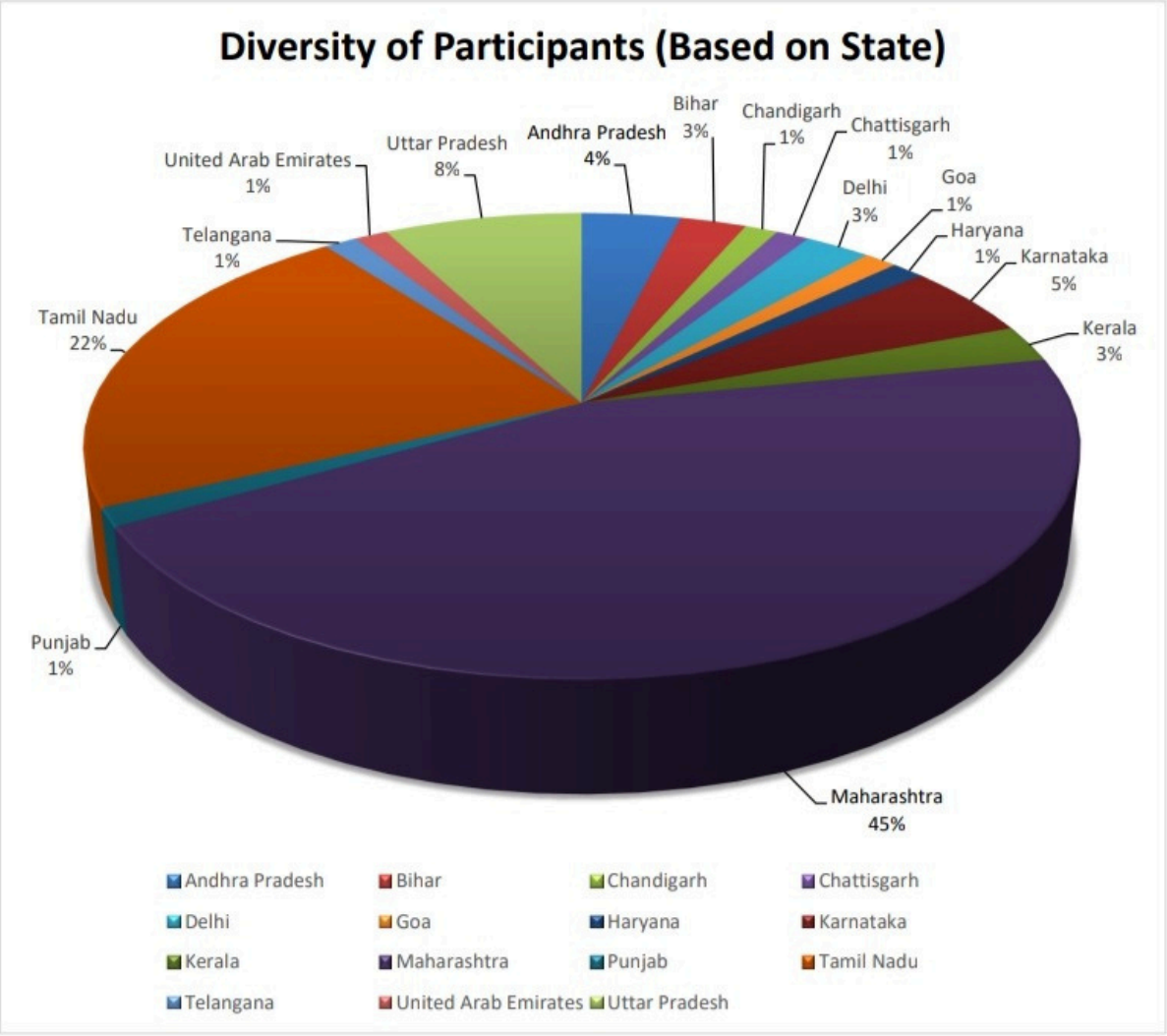
Mahindra University embodies Global Thinkers and Engaged Leaders, who deeply understand their role in the world and are committed to improving lives through active participation. They live by Mahindra Rise's values of No Limits, Positive Change, and Alternative Thinking, driving their actions. Embracing Mahindra Rise, they show unwavering dedication to overcoming challenges, inspiring change, and fostering innovation. This ethos cultivates creative problem-solving and fearless exploration. Mahindra University shapes individuals who excel in their fields and contribute to society, fostering empathy, ingenuity, and responsible stewardship. This prepares them to address global challenges today and tomorrow.

KEY HIGHLIGHTS






Diversity of Participants (Based on Grade of the Student)
Grade 7 5%
Grade 8 9%
Grade 9 29%
Grade 10 28%
Grade 11 12%
Grade 12 17%
Grade 7
Grade 8
Grade 9
Grade 10
Grade 11
Grade 12


Diversity of Participants (Based on State)
Andhra Pradesh 4%
Bihar 3%
Chandigarh 1%
Chattisgarh 1%
Delhi 3%
Goa 1%
Haryana 1%
Karnataka 5%
Kerala 3%
Maharashtra 45%
Punjab 1%
Tamil Nadu 22%
Telangana 1%
United Arab Emirates 1%
Uttar Pradesh 8%
Andhra Pradesh
Bihar
Chandigarh
Chattisgarh
Delhi
Goa
Haryana
Karnataka
Kerala
Maharashtra
Punjab
Tamil Nadu
Telangana
United Arab Emirates
Uttar Pradesh

Keynote Speakers

Pullela Gopichand is a former badminton player who has represented India in many prestigious tournaments. Currently, he is serving as the Chief National Coach of the Indian national badminton team. He is the recipient of many awards like Arjuna Award, Padma Bhushan, Padma Shri and Dronacharya Award. He delivered a highly motivating speech, sharing his life personal experiences and challenges he faced. He shared how he bounced back from each challenge and worked hard towards his goals. His talk was very inspiring.

The chief guest, Dr. K Subramanian, is a leading expert on economic policy, banking and corporate governance and is the youngest Chief Economic Advisor to the Government of India. He shared some brilliant occurrences that he experienced while working as the Chief Economic Advisor during the pandemic. He encouraged the participants to persevere through all the challenges that they would face in the pursuit of their goals.

Objective

The primary objective of Math.Biz 2023 was to expose students to the application based aspect of Mathematics in areas like Finance, Economics and Accounting. Students often learn Mathematics without knowing where they might find its application, but once they perceive the application of Mathematics in a particular field, it becomes all the more meaningful for them to learn Mathematics. Till date, there has been no programme other than Math. Biz 2023 that focuses on looking at Economics and Finance through the lens of Mathematics. The goal of Math.Biz 2023 was to get students to appreciate the beauty of the intersection of Mathematics with other disciplines.

Selection Procedure

Aspiring students from twenty Indian states and three foreign nations sent applications to participate in Math. Biz 2023. Out of hundreds of applications that were received, eighty applications were selected after a rigorous and challenging two hour selection test.

Pedagogy and Program Schedule

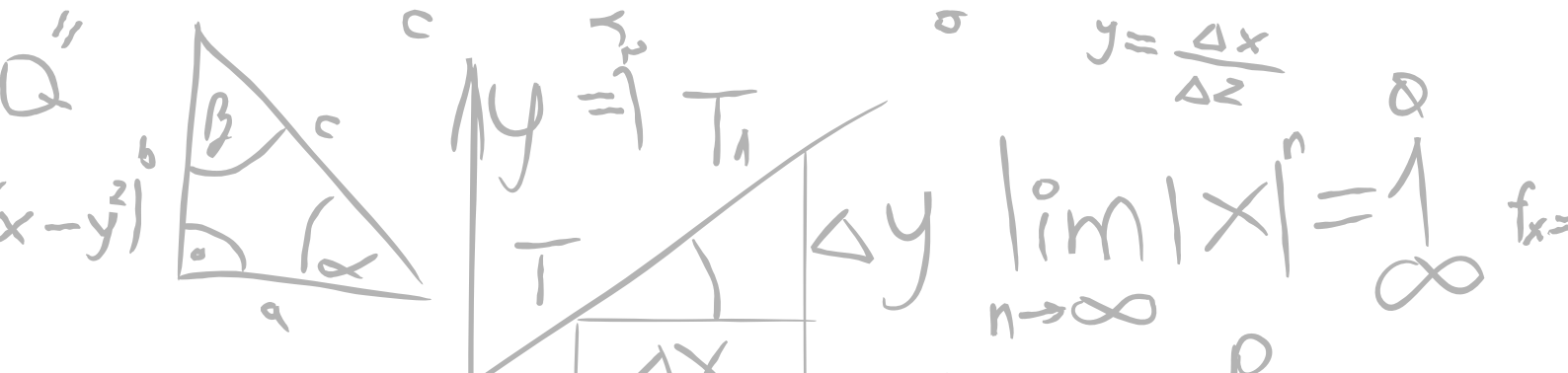
The selected participants were divided into two batches based on their grades and scores. The two batches were called ‘Small Caps’ and ‘Mid Caps’. A regular day at Math. Biz 2023 consisted of 3-4 sessions by the in-house faculty, along with 1-2 sessions by guest speakers. The sessions helped converge the speakers' expertise in different areas of mathematics. Each session was followed by a doubt clearing session which was handled by the teaching assistants. The participants were also involved in body movement and social emotional sessions that imparted valuable practical insight on social bonding and self expression. Throughout the duration of the camp, the participants were encouraged to ask questions and analyse the reasons behind every statement and proof. The participants derived different formulae and were excited to discover something new based on their deductions. All the sessions were highly interactive. While some of the questions posed by the participants evoked amusement in the speakers, others left the speakers baffled. The questions asked clearly indicated the keen, curious and intelligent nature of the participants.

Topics covered

Small Caps Batch

- Participants were introduced to essential concepts in economics and finance, such as Geometric Progression (GP) and its applications in compound interest and its variations.
- The session on Introduction to Financial Mathematics sparked great enthusiasm among attendees, covering topics like bonds, inflation, cashflows, and insurance. Introduction to Agency theory emphasised the importance of trust in markets through real-life anecdotes.
- Decision making in personal finance and the effects of compounding on assets were also discussed. Unconventional assets like NFTs and patents were introduced.
- Mathematical interpretations of financial concepts, including Elasticity of Demand and Central Tendency, were explored with lively discussions. Sessions on Cost Functions, Calculus, and Mathematics in Demography covered various finance-related terms and graphical analysis.
- Game theory, supply, demand, and quantity concepts were also part of the engaging lectures. Statistics sessions involved mean deviations, variance, covariance, and correlation with examples from tech companies.
- Bond valuation, price volatility, and foreign exchange were explained thoroughly. The regression session taught participants how to plot a line of best fit for small-cap and mid-cap stocks.

Overall, the sessions provided valuable insights into investing in stocks and bonds.



Mid Caps Batch

- In the session on Cost Functions and Introduction to Calculus, participants learned about finance terms and their mathematical applications.
- The Mathematics in Demography sessions discussed schemes, economic impacts on the population, and trade.
- Game Theory explored the Prisoners Dilemma and Nash Equilibrium. Other topics included supply, demand, and quantity concepts. Introduction to Agency Theory emphasised trust in markets with anecdotes and the compensation of unobservable ‘effort’ or ‘work’.
- Sessions on Congruence between Life Goals and Assets were interactive and interesting. In these sessions, discussion on finance and valuation helped participants to achieve their goals. Decision making in personal finance and future commodity depreciation were explored.
- Unconventional assets like NFTs and patents were introduced.
- Elasticity of Demand, Central Tendency, Dispersion, and the Relationship between AR, MR & E provided mathematical interpretations of financial concepts.
- Introduction to Financial Derivatives discussed models used in the financial market. Participants learned about financial market workings, organisations, and regulations.
- Discussions covered small-cap & mid-cap meanings, the importance of the US dollar in international markets, and foreign exchange practices. The world markets' interdependence was debated, and geopolitical history's impact on market trends was explored.
- Graphical methods were used to calculate dividends from stocks in Introduction to Portfolio Theory sessions, making investing in stocks and bonds easier to understand.

Combined Batch

- One of the speakers took the participants on a journey through the principle of mathematical induction. Pretty sure nobody has ever used a can of pringles chips to demonstrate the workings of induction.
- The participants took a dive into the world of permutations, combinations and applications of binomial theorem.
- They were also given some problems to try out at the end. They were taught one of the most important prerequisites for the rest of the course: random variables, expected values and some properties of expectation.
- There were sessions in which the participants explored various types of random variables and distributions such as the Binomial, Poisson and Normal distribution.
- They also had a lot of fun playing a game of dumb charades with the faculty and getting to know the TAs in informal sessions.

Speakers line up

Prof. Hariharan Ramasubramanian (Asst. Prof. at Frankfurt School of Finance and Management, Head of Academic Affairs and co-founder of RAM Foundation) taught Cost Functions and Introduction to Calculus, Introduction to Agency Theory, Bond Mathematics, Elasticity of Demand, Central Tendency, Dispersion and the Relationship between AR, MR & E and Linear Regression and Covariance and Correlation.

Dr. Sindhu Vasireddy (Assistant Professor in the Department of Economics and Finance at Mahindra University School of Management) took sessions on Mathematics in Demography.

CA Jayaprakash Rajangam (Chartered Accountant, Consultant for M&A, and Trustee of RAM Foundation) taught about Congruence between Life Goals and Assets.

CA Harish Menon (Chartered Accountant and Co-Founder - House of Alpha) took sessions on Forex and Introduction to Financial Derivatives.

Arunachalam R (Former Chief Actuary & Chief Risk Officer, SBI Life Insurance and President of Institute of Actuaries of India) took sessions on Introduction to Portfolio Theory.

Aadityan Ganesh (RAM Alumni, CMI alumni and incoming PhD student at Princeton University) took sessions on Binomial Theorem and Random Variables.

Vinay Nair (co-founder of RAM Foundation, Vichar Vatika & Director of Epsilon India) took a session on the Principle of Mathematical Induction.

Mokshit Kothari (RAM Alumni, CA and Actuarial Science aspirant) taught the most widely used concept Geometric Progression and took sessions on Introduction to Financial Mathematics.

Sundarraman Madhusudan (RAM alumni, MSc Data Science second year student) took sessions on Introduction to Probability Distribution.

GUEST LECTURES

Shailesh Kumar (Chief Data Scientist at the Centre of Excellence in AI/ML, Reliance Jio) delivered a lecture on demystifying Artificial Intelligence (AI). Dr. Shailesh Kumar simplified the jargon of AI for the participants, and made them differentiate between 'learning', 'thinking', 'understanding', 'intelligence' and other such terms. He also spoke about the evolution of learning, thinking and intelligence; and answered the participants' doubts about AI in general.

Chinmay Amte (EY Valuation & Modelling Associate Financial Modelling Content creator) gave the participants a chance to apply mathematical concepts to solve problems on Equated Monthly Instalments (EMI) and taxes using Excel. They worked on three different problems, using various Excel functions and features such as Goal Seek, PTM and Solver.

Anil Arya's (Department of Accounting and MIS at the Ohio State) session was an insightful approach towards understanding how big decisions get affected by the first few pieces of information which turn up. The participants explored the fascinating concepts of herd mentality and information cascade, and saw their real life examples; such as in the US Presidential Elections.

R. Gopalkrishna (Indian Railways, Chief Data and Analytics Officer) delivered a very informative session on Data Analytics and the Indian Railways. It was a unique journey through the process of data analysis, and how the government makes use of it for the smooth functioning of railways. The participants were shown examples of railway traffic control systems and their equivalent mathematical concepts.

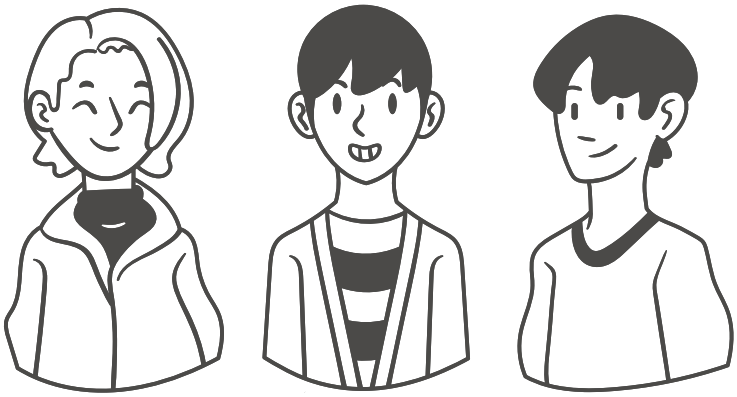
Aadityan Ganesh (graduate from CMI, Incoming PhD student at Princeton) took a session on how Auctions differ in case of Blockchains. The participants learnt about the fascinating intersection of game theory, economics and computer science/blockchains. participants also got a chance to bid in a mock auction.

Abhishek Nagraj (Faculty Research Fellow at National Bureau of Economic Research and an Assistant Professor in the Haas School of Business at the University of California, Berkeley) discussed finding connections in social and cognitive psychology and behavioural economics using mathematical statistical models.

Conclusion

The syllabus taught to the participants was vast - from blockchain to actuarial science; and that of graduate and CA entry level courses. The participants will have quite a lot of food for thought for the coming days and will apply the real world tools they learnt of in their future endeavours.

Math.Biz aims to bring the use of core mathematics in finance to light and provide participants with an arena of careers and opportunities that await their curious minds.



Supporters of Math.Biz 2023

The core course structure of Math.Biz was designed and delivered by Raising A Mathematician Foundation.

Mahindra University sponsored the venues, accommodation, food, and all associated logistical support.

The program was funded by Pravaha Foundation, which also covered socio-emotional learning and body movement workshops for the students.

Raising A Mathematician Foundation™

PRAVAHA

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Mahindra University