Department of

Applied Mathematics

Magazine

for

2021-22

Editorial Board

Message from HoD

The Department of Applied Mathematics at Delhi Technological University is the perfect place to get a comprehensive education in mathematics and its applications to engineering. The department provides courses in the fundamentals of mathematics as well as advanced topics such as calculus, linear algebra, and numerical analysis. Additionally, the department offers courses in computer programming, probabilistic modeling, statistics, and optimization that equip students with the necessary skills to become successful engineers. With experienced professors who are experts in their fields and a wide range of resources available for students, this department provides an invaluable opportunity for students interested in mathematics and engineering. The Department also offers B.Tech. in Mathematics and Computing Engineering program at our University, which is a hub of excellence for the students. We are proud to be able to provide our students with excellent placements and job opportunities. We also take great joy in providing them with various social, cultural and other activities that help them grow as individuals. Our B.Tech. students get to participate in a variety of activities that help them become well-rounded individuals, while also building their professional skillsets and preparing them for their future careers. Congratulations to all the students of Mathematics and Computer Engineering who have been accepted into globally renowned universities. It is a tremendous accomplishment and a reflection of their hard work and dedication. We wish them the best as they embark on this new journey, and know that they are more than ready to take full advantage of the opportunities ahead. As they carry on their studies, may they be blessed with success in abundance! As educators, we have a responsibility to ensure our students are equipped with the skills and knowledge to become good human beings and responsible citizens of our country. We at the Department strive to create an environment that fosters moral development, critical thinking, and civic engagement. Through interactive activities, meaningful discussions, and service-learning projects, we are committed to helping our students gain the skills necessary for them to make sound decisions in their lives and contribute positively to society.

-Prof. S. Sivaprasad Kumar

<u>Academic Initiatives of the Department</u>: The department has seen a surge in student numbers in current academic year with an increased intake of 61 for the M.Sc. program. This has resulted in a total of …students enrolled in B.Tech (Mathematics and Computing) and M.Sc. programs and ……in doctorate program.

Achievements/Highlights of the Department:

The department boasts an impressive roster of faculty and motivated students, who are continually engaged in a variety of academic pursuits in addition to their regular coursework. Here's a peek at some of the highlights:

Research Award: The University has been actively promoting research and innovation by providing a research and innovation environment to the students and faculties. In 2017, the University has started a Research Excellence Award to encourage and motivate faculties and students toward research in respective disciplines. The Award as been classified into three categories, namely, Outstanding Research Awards, Premier Research Awards, and Commendable Research Awards. The following publications were awarded to the Faculty members and Students of the Department of Applied Mathematics in the Research Excellence Awards ceremony held at DTU in March 2022.

Details of Commendable Research Awards

Authors	Paper Title	Journal Reference
Aditya Kaushik, Manju Sharma, Astha Gupta and Monika Choudhary	Iterative analytic approximation to one-dimensional nonlinear reaction- diffusion equations	*Mathematical Methods in the Applied Sciences (Wiley), vol. 44, no. 16, pp. 12152-12168, 2021, Impact Factor: 2.321.*
Aditya Kaushik, Vijayant Kumar, Manju Sharma and Nitika Sharma	A modified graded mesh and higher order finite element method for singularly perturbed reaction- diffusion problems	*Mathematics and Computers in Simulation (Elsevier), vol. 185, pp. 486-496, 2021, Impact Factor: 2.463*
Ajay Kumar and C.P. Singh	The generalized second law of thermodynamics in viscous Ricci dark energy model	*The European Physical Journal Plus (Springer), vol. 136, no. 820, pp. 1-20, 2021, Impact Factor: 3.911*
Anu Kumari and Satyabrata Adhikari	Classification witness operator for the classification of different subclasses of three-qubit GHZ class	*Quantum Information Processing (Springer), vol. 20, no. 316, 2021, Impact Factor: 2.349*

Anuma Garg and Satyabrata Adhikari	Teleportation criteria based on Maximum Eigenvalue of the shared d⊗d Dimensional Mixed State: Beyond Singlet Fraction	*International Journal of Theoretical Physics (Springer), vol. 60, pp. 1038-1052, 2021, Impact Factor: 1.708*
Astha Gupta and Aditya Kaushik	A robust spline difference method for robin-type reaction-diffusion problem using grid equidistribution	*Applied Mathematics and Computation (Elsevier), vol. 390, pp. 125597, 2021, Impact Factor: 4.091.*
C.P. Singh and Joan Sola Peracaula	Friedmann cosmology with decaying vacuum density in Brans-Dicke theory	*The European Physical Journal C (Springer), vol. 81, no. 960, pp. 1-16, 2021, Impact Factor: 4.590*
KM. Lipi and Naokant Deo	On Modification of Certain Exponential Type Operators Preserving Constant and e^{-x}	*Bulletin of the Malaysian Mathematical Sciences Society (Springure Nature), vol. 44, pp. 3269-3248, 2021, Impact Factor: 1.554*

Lukshay Batra and H.C. Taneja	Approximate analytical solution to the information measure's based quanto option pricing model	*Chaos, Solitons & Fractals (Elsevier), vol. 153, Part 1, pp. 111493, 2021, Impact Factor: 5.944.*
Nav Shakti Mishra and Naokant Deo	On the preservation of functions with exponential growth by modified Ismail-May operators	*Mathematical Methods in the Applied Sciences (Wiley), vol. 44, no. 11, pp. 9012-9025, 2021, Impact Factor: 2.321*
Parul Chauhan and Anjana Gupta	Matrix games with proportional linguistic payoffs	*Soft Computing (Springer), vol. 25, pp. 15067-15081, 2021, Impact Factor: 3.643.*
Radhika Kavra, Anjana Gupta and Sangita Kansal	Interval graph based energy efficient routing scheme for a connected topology in wireless sensor networks	*Wireless Networks (Springer), vol. 27, pp. 5085-5104, 2021, Impact Factor: 2.602*

Rajesh Asthana, Gurjit Singh Walia and Anjana Gupta	A novel biometric crypto system based on Cryptography key binding with user biometrics	*Multimedia Systems (Springer), vol. 27, pp. 877-891, 2021, Impact Factor: 1.935.*
Rajesh Asthana, Gurjit Singh Walia and Anjana Gupta	Random area-perimeter method for generation of unimodal and multimodal cancelable biometric templates	*Applied Intelligence (Springer), vol. 51, pp. 7281-7297, 2021, Impact Factor: 5.086.*
Richa Rohira, Shreya Sanduja and Satyabrata Adhikari	Construction of a family of positive but not completely positive map for the detection of bound entangled states	*Quantum Information Processing (Springer), vol. 20, no. 374, 2021, Impact Factor: 2.349.*
Ruchika Lochab and Vivek Kumar	A new reconstruction of numerical fluxes for conservation laws using fuzzy operators	*International Journal for Numerical Methods in Fluids (Wiley), vol. 93, no. 6, pp. 1690-1711, 2021, Impact Factor: 2.107.*

Ruchika Lochab and Vivek Kumar	An improved flux limiter using fuzzy modifiers for Hyperbolic Conservation laws	*Mathematics and Computers in Simulation (Elsevier), vol. 181, pp. 16-37, 2021, Impact Factor 2.463.*
S. Sivaprasad Kumar and K. Gangania	On Geometrical Properties of Certain Analytical Functions	*Iranian Journal of Science and Technology, Transactions A: Science (Springer), vol. 45, pp. 1437-1445, 2021, Impact Factor: 1.194*
S. Sivaprasad Kumar and K. Gangania	A cardioid domain and starlike functions	*Analysis and Mathematical Physics (Springer), vol.11, no. 2, pp. 1-34, 2021, Impact Factor: 1.548.*
S. Sivaprasad Kumar and Shagun Banga	On Certain Exact Differential Subordinations Involving Convex Dominants	*Mediterranean Journal of Mathematics (Springer), vol. 18, no. 6, pp. 1-15, 2021, Impact Factor: 1.400.*

Satyabrata Adhikari	Constructing a ball of separable and absolutely separable States for $2 \otimes d$ quantum system	The European Physical Journal D (Springer), vol. 75, no. 3, pp. 1-13, 2021, Impact Factor: 1.425.
Shruti Aggarwal and Satyabrata Adhikari	Witness operator provides better estimate of the lower bound of concurrence of bipartite bound entangled states in $d1 \otimes d2$ -dimensional system	Quantum Information Processing (Springer), vol. 20, no. 3, pp. 1-26, 2021, Impact Factor: 2.349.
Simran Kaur and C.P. Singh	Constraints on holographic dark energy model with matter creation in Brans-Dicke theory and thermodynamics analysis	Physics of the dark universe (Elsevier), vol. 33, pp. 100869, 2021, Impact Factor: 4.243
Vivek Kumar and Gunter Leugering	Singularly perturbed reaction-diffusion problems on a k-star graph	Mathematical Methods in the Applied Sciences (Wiley), vol. 44, no. 18, pp. 14874-14891, 2021, Impact Factor: 2.321.

- **Publications-** Faculty members of the department have achieved remarkable success in their research publications this year, with numerous awards for excellence in publication category. This work has been featured in a variety of esteemed journals and conferences, making this truly remarkable year for department and DTU:

- Aman Choudhary and **Luckshay Batra** published a paper titled as "Defining the Undefined", Global Philosophy, 32, 1401-1413 (2021), SCOPUS, UGC-CARE List (India).

- **Ankit Sharma**, Harendra Pal Singh and **Nilam** published a paper titled as "A Mathematical Survey of mathematical model-based control techniques based on open and closed loop control approach for diabetes management" in International Journal of Biomathematics, Volume 15, 07 (2022).

- **Ankit Sharma, Nilam**, H.P. Singh published a paper titled as "Computer-controlled diabetes disease diagnosis technique based on fuzzy inference structure for Insulin-dependent patients" in Applied Intelligence, Volume 53, 2022.

- **Anu Kumari, Satyabrata Adhikari** published a paper titled as "Structural physical approximation of partial transposition makes possible to distinguish SLOCC inequivalent classes of three-qubit system" in The European Physical Journal D 76 73 (2022).

- **Anu Kumari, Satyabrata Adhikari** published a paper titled as "Structured Negativity: A physically realizable measure of entanglement based on structural physical approximation", Annals of Physics 446 169113 (2022).

- **Chandra Prakash**, Durvesh kumar verma, **Naokant deo** published a paper titled as "Approximation by a new sequence of operators involving apostol-genocchi polynomials", Mathematica slovaca , 71(2021), no. 5, 1179-1188.

- **Chandra Prakash**, Durvesh Kumar Verma, **Naokant Deo** published a paper titled as "Approximation by durrmeyer variant of cheney-sharma chlodovsky operators",

Mathematical Foundations of computing, (2022).

- **Chandra prakash, Naokant Deo**, and D. K. Verma published a paper titled as "Bezier variant of bernstein- durrmeyer blending type operators", Asian-European journal of mathematics (world scientific), (2022).

- **Chandra Prakash, Naokant Deo**, D. K. Verma published a paper titled as "Approximation by Apostol-genocchi summation-integral type operators", Miskolc mathematical notes, (2021).

- **Kanchan Jangra, Dinesh Udar** published a paper titled as "On almost s-weakly regular rings," Turkish Journal of Mathematics, Vol. No. 46, pp. 1897, 2022.

- **Kavra, R., Gupta, A. & Kansal, S.** published a paper titled as "Systematic study of topology control methods and routing techniques in wireless sensor networks" Peer-to-Peer Netw. Appl. 15, 1862–1922 (2022).

- **Km. Lipi and Naokant Deo** published a paper titled as "Approximation properties of modified Gamma operators preserving tv" ,Ann. Funct. Anal., 13(2) (2022), Article 26.

- **Luckshay Batra and H.C. Taneja** published a paper titled as "Comparison between Information Theoretic Measures to Assess Financial Markets", Fintech, 1(2), 137-154, (2022), EBSCO.

- **Neha and Naokant Deo** published a paper titled as "Integral modification of Apostol-Genocchi operators," Filomat, Volume 35:8 (2021), Pages 2533–2544.

- **Neha, Naokant Deo** published a paper titled as "Integral modification of Beta-Apostol-Genocchi operators" in "Mathematical Foundations of Computing Mathematical." (2022).

- **Neha**, Rampratap and **Naokant Deo** published a paper titled as "Bezier Variant of summation-integral type Operators in "Rendiconti del circolo Matematico di palermo series 2". (2022).

- **Shruti Aggarwal, Satyabrata Adhikari** published a paper titled as "Search for an efficient entanglement witness operator for bound entangled states in bipartite quantum systems", Annals of Physics, Vol. No. 444, pp. 169043, 2022.

- **Swati and Nilam** published a paper titled as "Fractional order SIR epidemic model with Beddington–De Angelis incidence and Holling type II treatment rate for COVID-19", Journal of Applied Mathematics and computing,68,3835-3859 (2022).

- **Vineet** published a paper titled as "Solution of Transportation Problem Under Spherical Fuzzy Set" in IEEE 6th International Conference on Computing Communication and Automation (ICCCA) Organized by Aurel Vlaicu University of Arad, Romania and Galgotias University, India on Dec. 17-19, 2021 at Galgotias University Greater, Noida

- **Vineet** published a paper titled as "Solution of Transportation Problem using Interval -Valued Pythagorean Fuzzy Approach" in International Conference on Advanced Engineering Optimization Through Intelligent Techniques (AEOTIT) Organized by the Department of Mechanical Engineering, Sardar Vallabhbhai National Institute of Technology, Surat, Gujarat State, India, during 28th -30th January 2022.

- **Yash Sharma**, S. Sharma and **Anshul Arora** published a paper titled as "Feature Ranking using Statistical Techniques for Computer Networks Intrusion Detection," 2022 7th International Conference on Communication and Electronics Systems (ICCES), Coimbatore, India, 2022, pp. 761-765.

<u>Invited Talks/Paper presentations</u>: Faculty and students from the department have had the opportunity to visit other institutes and Universities to deliver invited talks and present their research at esteemed conference and workshop. Have a look at the details for the academic year 2021-2022:

Invited Talks:

- **Prof. H.C. Taneja** had an Expert lecture on the topic 'Markov Chain and its Applications' in the 'International Conference on Advance Trends in Computational Mathematics, Statistics & OR', 2022.

- **Prof. H.C. Taneja** was invited for an Expert lecture on the topic 'Information Theory & Its Applications' in the AICTE Training and Learning (ATAL) (2021).

- **Prof. H.C. Taneja** was invited for an Expert lecture on the topic 'Mathematics & its application aspects' in one-day webinar to celebrate national mathematics day, IGU Meerpur, Rewari (2021).

- **Prof. Sangita Kansal** was invited for an Expert Lecture on the topic 'Modelling Through Signed Petrinet' in the 'International conference of IAPs on recent advances in mathematical and computational optimization', 2022.

- **Prof. Sangita Kansal** was invited for an Expert Lecture on the topic 'Signed Petrinet and its Applications' in the Advanced Mathematical Techniques in Engineering and Technology, MDU, Rohtak (2021).

- **Prof. Naokant Deo** was invited as a Speaker for the topic: Convergence Estimates - an overview, Refresher Course on "Non-linear Analysis for the Development of Neural Network System" Department of Mathematics, G. G. University, Bilaspur, Chhattisgarh, 24th September 2021.

- **Prof. Naokant Deo** was invited as a Speaker for the topic: Direct Estimates in Approximation, Refresher Course in Applied Mathematics, Ranchi University, Ranchi, Jharkhand, 23rd September 2021.

- **Dr. Satyabrata Adhikari** was invited for an Expert lecture on the topic 'Structural Physical Approximation of Partial Transposition' in the 'Summer School of Quantum Information and Quantum Technology', 2022.

- **Dr. Satyabrata Adhikari** was invited for an Expert lecture on the topic 'Graph theoretical approach to detect the $d_1 \otimes d_2$ dimensional bipartite entangled system' in

the International Conference on Quantum Information and Foundations (ICQIF-2022).

- **Dr. Satyabrata Adhikari** was invited for an Expert lecture on the topic 'Quantum Teleportation' in DRDO Sponsored One Week Online Workshop on "Quantum Computing" (2022).

- **Dr. Satyabrata Adhikari** was invited for an Expert lecture on the topic 'Quantum Teleportation and Superdense Coding' in the AICTE Training and Learning (ATAL) Academy Online Elementary FDP on "Quantum Computing" (2021).

- **Dr. Satyabrata Adhikari** was invited for an Expert lecture on the topic 'Quantum Cryptography' in the AICTE Training and Learning (ATAL) Academy Online Elementary FDP on Quantum Information Processing & Applications, Central University of Punjab (2021).

- **Mr. Rohit Kumar** was invited for an Expert lecture on the topic 'Mathematica Software and Its Applications in "MODULUS", Sri Guru Gobind Singh College of Commerce (University of Delhi) (2021).

- **Dr. Goonjan Jain** was invited for an Expert lecture on the topic 'Natural Language Processing' in the '3-day 5th International Conference on Recent Advances in Mathematical Sciences with Applications in Engineering and Technology', 2022.

- **Dr. Goonjan Jain** was invited for an Expert lecture on the topic 'Natural Language Processing' in the 'International Conference on Multi-Disciplinary Application & Research Technologies (ICMART 2022)'.

- **Dr. Goonjan Jain** was invited for an Expert lecture on the topic 'Natural Language Processing' in the 27th International Conference of IAPS (online) on Recent Advances in Mathematics & Computational Optimizations (RAMCO) (2021).

- **Dr. Dhirendra Kumar** was invited for an Expert lecture on the topic 'Cryptography and Coding Theory' in Two- Days Workshop on Departmental Specific Electives offered in M.Sc. Curriculum (2022).

- **Dr. Dhirendra Kumar** was invited for an Expert lecture on the topic 'Medical Image Segmentation using Fuzzy Set' in the department of Computer Science and Engineering, KLEF, Hyderabad, Telangana (2021).

- **Dr. Dhirendra Kumar** was invited for an Expert lecture on the topic 'Bias-corrected intuitionistic fuzzy c-means with spatial neighborhood information approach for human brain MRI image segmentation' in the International Conference on Recent Advances in Mathematics & Computational Optimizations (RAMCO-2021).

- **Dr. Anshul Arora** was invited for an Expert lecture on the topic 'How to Detect Mobile Malfunctioning' in Gurugram University (in online mode) (2021).

- **Mr. Ankit Sharma** Delivered a Talk on the topic "Information and Communication Technology" organized by Swami Sharadhanand College, University of Delhi, on 13 March, 2022.

Paper Presentations:

- **Prof. H.C. Taneja** presented a paper on "Black-Scholes Option Pricing using Machine Learning" in the FIM-IMIP-UMSO2021, Online International Conference Kitakyushu (City), Japan (2021).

  Prof. H.C. Taneja presented a paper on "Information Theoretic Measures Approach To Assess Financial Markets" in the FIM-IMIP-UMSO2021, Online International Conference Kitakyushu (City), Japan (2021).

- **Prof. H.C. Taneja** presented a paper on "Solution of transportation problem under interval-valued Pythagorean fuzzy set" in the 11th international congress on natural sciences and engineering, MUS, turkey (2021).

- **Dr. Dinesh Udar** presented a paper titled "On Weakly g(x)-Invo Clean rings" in the 5th International Conference on Recent Advances in Mathematical Sciences and Its Applications (RAMSA – 2021).

- **Dr. Dinesh Udar** presented a paper titled "Self Dual and modified codes over Q8 Group Rings" in the 5th International Conference on Recent Advances in Mathematical Sciences and Its Applications (RAMSA – 2021).

- **Mr. Abhay Srivastava** presented a paper in International conference on dynamical systems, control and their applications, 03 July, 2022, IIT Roorkee.

- **Mr. Ankit Sharma** presented a paper titled as "Physical Exercises: Effective Aspect in Diabetes Management", 04-06 March, 2022, organized by University of Technology, Sydeny, Australia.

- **Mr. Chandra Prakash** presented the paper titled as "Approximation by α–Bernstein operators based on certain parameters" at International Conference on Evolution in Pure & Applied Mathematics, the Department of Mathematics, Akal University, Talwandi Sabo, Bathinda (2022).

- **Mr. Chandra Prakash** presented the paper titled as "Approximation by the operators using Apostol-Genocchi Polynomials" at 2nd International conference on non-linear applied Analysis and Optimization, the Department of Mathematical Science, Indian Institute of Technology (BHU)- Varanasi (2022).

- **Mr. Monu Yadav** presented a paper titled as "Identification of storm eye from satellite image data using fuzzy logic with machine learning" in Two Day Conference on Recent Trends in Mathematical and Computational Sciences during July 28-29, 2022, at Amity University Kolkata, West Bengal.

- **Mr. Monu Yadav** presented a paper titled as "Optimal Packing Routing with Multiple demands and link lines" in the 6th International Conference on ICT for Sustainable Development during August 5-6, 2021 at Goa, India.

- **Mr. Monu Yadav** presented a paper titled as "Review of various methods for estimating the intensity of Tropical Cyclone YAAS" in International Conference on Evolution in Pure & Applied Mathematics during November 16-18, 2022 at Akal University, Bhatinda, Punjab.

- **Mr. Surya Giri** presented a paper titled as "Hermitian Toeplitz determinant for certain univalent functions, Department of Mathematics" in International Conference on Evolution in Pure and Applied Mathematics, during November 16-18, 2022 organised by Akal University, Bathinda, Punjab, India.

- **Mr. Surya Giri** presented a paper titled as "Toeplitz Determinants for a Subclass of Quasi Convex Mappings in Higher Dimensions" in International Conference on Mathematical Analysis and Applications during December 15-17, 2022 organized by, National Institute of Technology, Tiruchirappalli, Tamil Nadu, INDIA,

- **Mr. Vineet** Presented a paper "Solution of Pythagorean Fuzzy Linear Programming Problem by Using Similarity Measure" in 27th International Conference on Recent Advances in Mathematical and Computational Optimization Organized by School of Computational and Integrative Science, Jawaharlal Nehru University, Oct 26-28, 2021.

- **Mr. Vineet** presented a paper "Solution of Transportation Problem under Interval-Valued Pythagorean Fuzzy set" in 11th International Conference on Natural Science and Engineering, Sept 18-19, 2021, Mus, Turkey.

- **Mr. Yash Sharma** presented the paper titled as "Feature Ranking using Statistical techniques for Computer Networks Intrusion Detection" at the 7th International conference on Communication and Electronics Systems (ICCES-2022), organized by PPG Institute of Technology, Coimbatore, Tamil Nadu, India held during 22-24, June 2022.

- **Ms. Anuma Garg** presented a paper "Eigenvalue Criterion for Quantum Teleportation Protocol" at 5th International Conference on Recent Advances in Mathematical Sciences and it's Applications (RAMSA-2021), organized by Jaypee Institute of Information Technology, Noida, India (2021).

- **Ms. Anuma Garg** presented a paper "Usefulness of shared entangled state in quantum teleportation by eigen value criteria" at First International Conference on

Agriculture, Science, Engineering and Management (ICASEM-2021), organized by Sanskriti University, Mathura, Uttar Pradesh, (2021).

- **Ms. Kanchan** presented a paper titled as " A note on s-weakly regular rings" in Emerging trends in Pure and Applied Mathematics, during 12-13 March 2022, organized by Department of Applied Sciences, School of Engineering in association with Department of Mathematical Sciences, School of Sciencs, Tezpur University, Assam, India.

- **Ms. Kanchan** presented a paper titled as "On weakly g(x)-invo clean rings" in 5th International Conference on Recent Advances in Mathematical Sciences and its Applications, during 02-04 dec 2021, organized by Department of Mathematics Jaypee Institute of Information Technology, Noida, india.

- **Ms. Lipi** presented a paper titled as "A note on Ismail-May operators preserving the exponential function" in the International Conference on Emerging trends in Pure and Applied Mathematics held during March 12-13, 2022, Tezpur University, Assam.

- **Ms. Mahima** presented a paper titled as "Permissions Ranking with Statistical Techniques for Android Malware Detection" in International Conference on Computational Intelligence and Smart Communication, during 10-11 June, organized by Dev Bhoomi Uttrakhand University, Dehradun, India.

- **Ms. Mridula Mundalia** presented a paper titled as "Coefficient functionals for a class associated with Hyperbolic Cosine function" in International Conference on Mathematical Analysis and Applications (ICMAA), held during 15-17 Dec, 2022 at NIT Trichy.

- **Ms. Mridula Mundalia** presented a paper titled as "On Coefficient Bounds for certain classes of univalent functions" in International Conference on Emerging Trends in Pure and Applied Mathematics, held during March 12-13, 2022 at Tezpur University.

- **Ms. Neha Kajla** presented a paper titled as "Jain-Durrmeyer operators involving Apostol-Genocchi polynomial" in the International Conference on Emerging Trends in

Pure and Applied Mathematics (2022) in blended mode organized by Department of Applied Sciences, School of Engineering in association with Department of Mathematical Sciences, School of Science, Tezpur University.

- **Ms. Neha Kajla** presented a paper titled as "On approximation of functions with exponential growth by using modified Lupas-Kantrovich operators" in the International Conference on Mathematical Analysis and Applications (2022) in blended mode organized by department of mathematics, National Institute of Technology Tiruchirappalli.

- **Ms. Neha** presented a paper titled as "A Conjecture on Third Hankel Determinant for starlike functions associated with Cardioid Function" in 5th International conference on Mathematical Modelling, Applied Analysis and Computation-2022, during August 04-06, 2022 organised by JECRC University, Jaipur, Rajasthan, India.

- **Ms. Neha** presented a paper titled as "A Detailed Study of Ma-Minda Class of Functions" in International conference on Emerging trends in Pure and Applied Mathematics, during March 12-23, 2022 organised by Tezpur University, Assam, India.

- **Ms. Neha Punetha** presented the paper titled as "Sentiment Analysis of Stock Prices and News Headlines Using the MCDM Framework" at 4th international conference on Artificial intelligence & Speech Technology, 2022, IGWDTU.

- **Ms. Radhika Kavra** presented a paper titled as "Energy optimized routing topology for a connected graph model of wireless sensor networks" in 2nd International conference on Applied Mathematics in Science and Engineering, during 24-26 March, 2022, organized by Centre for Data Science (ITER) and Siksha 'O' Anusandhan (Deemed to be University).

- **Ms. Shruti Aggarwal** presented a paper titled as "Detection and quantification of entanglement using witness operator in mixed bipartite quantum states" in the International symposium in honor of great mathematician Srinivasa Ramanujan on

National Mathematics Day held on 22 December, 2021 at Dr. Harisingh Gour Vishwavidyalaya, Sagar, M.P. INDIA.

- **Ms. Shruti Aggarwal** presented a paper titled as "Improved lower bound of concurrence for arbitrary bipartite entangled states" in 5th International Conference on "Recent Advances in Mathematical Sciences and its Applications (RAMSA-2021)" scheduled from December 02-04, 2021 at Jaypee Institute of Information Technology, Noida, India.

- **Ms. Shruti Aggarwal** presented a paper titled as "Improved lower bound of concurrence for arbitrary bipartite entangled states" in the three-Day 27th International Conference on Recent Advances in Mathematics & Computational Optimizations at School of Computational and Integrative Sciences, JNU, New Delhi-110067, India, under the auspices of IAPS during October 26th -28th; 2021.

Programs organized by the Department:

- **Prof. Aditya Kaushik** organized a workshop titled 'My Story - Motivational Session by Successful Innovators ' organized by the Department of Applied Mathematics, DTU from 26 November 2021 to 26 November 2021.

- **Dr. Goonjan Jain** organized workshop titled 'Maple 2022 and its applications' organized by Department of Applied Mathematics, DTU from 26 May 2022 to 27 May 2022.

- **Ms. Payal** organized workshop titled 'Maple 2022 and its applications ' organized by Delhi Technological University from 26 May 2022 to 27 May 2022.

- **Ms. Sumedha Seniaray** organized workshop titled 'Two-days workshop on "Departmental Specific Elective offered in M. Sc. Curriculum"' organized by Department of Applied Mathematics, DTU from 05 May 2022 to 06 May 2022.

Other Achievements of our Research Scholars:

- Mr. Yash Sharma qualified CSIR JRF-2021 and GATE-2021.

- Ms. Annie Kaushik qualified CSIR JRF-2021.

- Mr. Abhay Srivastava qualified GATE-2022.

- Ms. Kanita qualified GATE-2021.

- Ms. Shivani Jain qualified GATE-2021.

- Ms. Himani Pokhriyal qualified GATE-2021.

- Mr. Luckshay Batra qualified GATE-2022.

- Ms. Anuma Garg got the Best Presenter Award in Research Scholar Category in First International Conference on Agriculture, Science, Engineering and Management (ICASEM-2021) organized by Sanskriti University, Mathura, Uttar Pradesh, India during 23-24 October, 2021.

- Ms. Anjali Awarded by Bronze Medal in "Azadi ka Amrit Mahotsav- Freedom Run" on the occasion of India's 75th Independence Day organized by DTU Sports Council.

Achievements of our Master's Students:

- Vidipt Vashist Secured AIR 46 Gate Mathematics 2022.

- Prince Secured AIR 281 GATE MA 2022.

- Prince has completed M.Tech. Industrial Mathematics and Scientific Computing, IIT MADRAS

- Mansi Bhardwaj got a Campus placement in the company "Galytix" at the Post of Data Analyst.

Placements: **Mathematics and Computing students have been a popular pick for prestigious companies and big banks around the world. The placement report for 2021-22 has just been released and its looking good:**

Established in year (2011), the Department of Applied Mathematics is a renowned center offering B.Tech in Mathematics & Computing Engineering. In the couple of years, the Department of Applied Mathematics, has grown expertise and competency in delivering science-based engineering curriculum. This year has witnessed some of the giant corporates offering coveted jobs across sectors and recruiting in large numbers, which was pivotal for the success of the placement season 2021-22. The placement season has seen recruiters from the entire spectrum of the industry like Engineering, Information Technology, Software programming, Research, Consulting, Finance, Banking and Services. The highest number of offers were rolled out by the Engineering and Technology sector. Students participated in the placement process from the Mathematics & Computing Branch. Students have received more than 140 offers from various tech giants like Microsoft, Amazon, Capgemini, Sprinklr, American Express, Paytm and many more. Our students have received offers with a minimum CTC of 4.2 LPA and a maximum CTC of 35.8 LPA, with an average CTC of 13.1 LPA and a median CTC of 11.5 LPA.

Extra-Curricular activities of the Department-

The department is dedicated to the holistic development of students and has two technical societies namely: MACS and SIAM. A number of activities have been performed by both the societies, the details for which have been given below:

MACS acronym for Mathematics and Computing Society, MACS DTU, the Mathematics and Computing Society of Delhi Technological University is the tavern for the snollygosters and esurient for the profound knowledge of each domain belonging to Mathematics, Computing, Finance etc. The academic year 2021-2022 was no exception and MACS hosted various indigenous as well as extrinsic events. Directed to introduce

and inculcate the interest and the plenitude of perquisites that the discipline of mathematics and various scions of computing proffer.

1.   **Maths Gala:** On December 22, 2021, MACS DTU organised a Maths Gala to commemorate the National Mathematics Day, which is the birthday of one of the greatest Indian mathematicians, Srinivasa Ramanujan. Three events were organised, a mathematical quiz, chess competition and movie night. In The Quiz, top 3 were selected and awarded a cash prize along with a Certificate of Achievement. In the Chess, the top 3 geniuses who checkmate first earned the title of chess god and took home exciting cash prizes along with a certificate of achievement. MACS DTU organised a movie night on the National Mathematics Day and with people from outside the society as well, watched The Man Who Knew Infinity which is Srinivasa Ramanujan's Biopic. It is a historical movie that revolves around his life and his relationship with the esteemed mathematician, Prof. G H Hardy.

2.   **Orientation:** On the auspicious day of 4th January 2022, MACS-DTU organised it's orientation session for freshers that showcased a massive participation of more than 250 enthusiastic freshers. The event took place on Google Meet platform. The aim of the event was to provide academic assistance to aspiring students, explaining the purpose and perks of joining MACS, explaining road maps for coding and placements and interaction with seniors.

3.   **Programming Fundamentals RoadMap:** On 26th January, 2022, MACS-DTU had conducted a session on Programming Fundamentals which was taken by **Mr. Aksht Jain**, placed at Rippling, Candidate Master on CodeForces and Ex Vice-President of MACS-DTU. This session was conducted just to have an amazing interaction with our new recruits and to provide them exciting insights on how to begin your journey with programming and the most efficient road-map to kick start their programming. The session was extremely amazing and participants were full of great enthusiasm.

4.   **Special Interest Groups - SIGs**: 1st, 2nd and 3rd February 2022 has a remarkable presence in the calendar of Mathematics and computing society DTU for successful completion of the first SIG for MA101 this year. The event took place on

Google meet and witnessed a massive participation of more than 100 enthusiastic learners along with shrewd seniors.

5. **Roadmap for CP and DSA:** Collaboration with Coding Ninjas: MACS, in collaboration with Coding Ninjas conducted a webinar on Data Structures and Algorithms and Competitive Programming on February 12th, 2022 in the online mode. The speaker of the day was Mr. Aditya Kumar, an alum of BITS Pilani, currently placed at Standard Chartered. The event took place on Google Meet and there were more than a 100 participants in the session. Webinar was followed up by a quiz also conducted in collaboration with Coding Ninjas that included prizes and swags worth Rs. 4.5K and was conducted in the next week.

6. **Web Development Workshop, collaboration with CLIMB:** On 5th March 2022, A workshop was organized by CLIMB DTU in collaboration with MACS DTU as a part of Parakram, a fundraiser for the NGO Make Love Not Scars.The speaker was Mr. Abhinav Gautam, placed and currently interning at Urban Company. This was a paid webinar and all earnings went to an NGO working for underprivileged acid-attack victims.

7. **GSoC-101: Everything to know about GSoC '22:** GSoC is one of the best events of the year but freshers don't always know about it. Keeping this in mind, MACS organised a webinar on GSoC. Saahil Ali, GSoC'21 and Github Extern'22, was the key speaker for this workshop. The workshop was open for all students and attended by more than a hundred.

8. **INVICTUS 2022:** MACS, the Mathematics and Computing Society of DTU was a core contributor in the success of this fest and led the logistics department. It organised 5 events, 2 of which were in collaboration with other technical societies of DTU:

9. **Matheletics:** On 23rd April 2022, MACS-DTU, Mathematics and Computing Society of Delhi Technological University organized A head-scratching and challenging mathematical quiz. It was a thrill-filled 2 rounds followed by a grand faceoff finale.The winners have been rewarded a cash prize worth Rs. 10,000.

10. **Mathemapics:** On 23rd April 2022, MACS-DTU, Mathematics and Computing

Society of Delhi Technological University organized a two-round competition where participants tried to use their brains to figure out mathematical patterns, history and cultures hidden in pictures.The winners were rewarded a cash prize worth Rs. 10,000.

11.   **Number Auction:** MACS Organised a number auction which is an interesting take on some concepts of Game Theory. Participants were given a fixed amount and they needed to buy 3 numbers from the range 1 to 50 such that their sum was minimized.

12.   **Prize Distribution Ceremony:** All winners of the events organised by MACS-DTU were felicitated with certificates as well as their cash prizes by the Head of the Department of Applied Mathematics, Prof. S. Sivaprasad Kumar as well as Associated Head, Prof. C. P. Singh in the presence of Dr. Dinesh Udar, Assistant Professor, Department of Applied Mathematics as well as Dr. Vivek Kumar Aggarwal, Assistant Professor, Department of Applied Mathematics.

13.   **Machine Learning Seminar:** On 24th April 2022, MACS DTU along with the Department of Mathematics presented a seminar, the first session of a ML and Data Science Workshop by MACS DTU. MACS invited Mr. Tejas Indulal Dhamecha, Senior Research Scientist and Manager at IBM Research AI, to serve as the keynote speaker for the seminar.The seminar concluded with a small Q/A session with the attendees asking their respective doubts.Over a 100 students attended the seminar and were captivated by the intriguing world of ML and Data Science set forth by Mr. Tejas Indulal Dhamecha.

14.   **Process Mining Seminar:** On 30 April 2022, A seminar into the fascinating realm of Process Mining was held by MACS DTU along with the Department of Mathematics, DTU as the second session of the ML and Data Science Workshop. The keynote speaker of the session was Monika Gupta, who is currently placed at IBM Research. She guided the participants through the domain of process mining and its various applications.The program concluded with a quiz on ML with cash prizes worth Rs 1000, which was enthusiastically taken part in by all the participants.

Literary Section

The Department is really pushing their students to go beyond their comfort zone and striving to bring out the creative side of their students. The faculty members of the department are not only offering a range of initiatives to help them do this, but contributing in various capacities. Some of which are outlined below:

1. **Article by Prof. L.N. Das**

   Computer program fundamentals and multimedia process working schemes

The computer program writes and execution tasks through the multimedia computing system is a series of tasks made up with certain basic fundamental concepts of programming. The beginner programmer has not thoroughly accustomed with the Computer power operating system, electromagnetic memory process, central unit process architecture, data structure and database management of the system. We are briefing the following attributes for realizing what is actually done in a computer executable coded programming environment.

1. The data constants and the variable declaration through the input devices keyboard, and output writing device screen, utilizing the basic syntax and data type structures.

2. Flow control structures (conditionals and loops)

3. Logic programming languages: Assembler, and Linker,

4. Object orient functional programming: Loader, and Compiler

5. interpreter

6. Debugger

A computer program consists of codes that are algebraic geometric symbols output of the keyboard typesets. Specific scripting syntax formal assembly languages are used to compile the codes into forming machine understandable codes. A compiler translates lines of code from the programming language into the machine language named as objects. The computer central process units link its readable electromagnetic registers with the random accessed space clock time through the power system execution logic gates which is named linker. A linker creates link between two programs and holds one or more object files for a specific time interval, which are created by the compiler. In the other word, linker links machine language registers cells with the ROM that read the bit strings and interpret the pulse latch amplitude frequency map into the transducer that passes current utilizing RAM Log file space. This phased task of data movement is known as loader. The transit response signal from the log file space into the computer's central processor unit is relayed and transmitted through the computer power system logic gates. A loader loads the data, instruction, and program into the memory in the main database or programmed data stacks.

During a linking, loading and compiling phase trough the computer LAN telnet call, if any transmission error occurs that is debugged through the debugger. The data link, data load, call transmission, and the data transmission error debug tasks are done by the scheduled electronic gates which are observed through the viewable graphic adaptor or VGA screen operating software and optoelectronic processors in the computer.

The electronic media are supersonic subsonic scalable ultrasound wave acoustic system having microphones and speaker phones operated with modulate or scalable finite range sound waves OPAM. The photovoltaic light particle kinetic motion data printable region viewer and polarized light shaped graphical fonts emitted reflection recognize, actuation, compare and scaling tasks are made by the interpreter program etc.

If a computer executable program is loaded, the system works out a series of tasks following the run command icon logic switch press instants. It assembles, compiles, and links the program syntax with semantic parse forms. If there is any floating point

numeric, data signal error exists, the suggestions and interpretations are displayed in the screen by the debugger and interpreter routine schemes.

2. Poem by Abhay Srivastava

Zn-Dn (प्रेम प्रसंग) [Abstract algebra]

तुम Dn सी Non abelian हो,

मैं cyclic group का generator प्रिये ।

तुम rotation reflection की geometry हो,

मैं Zn का element integer प्रिये ।

तुम group तक सीमित असामाजिक हो,

मैं prime पर बनाता field प्रिये।

तुम even n पर व्यवहार बदलती,

मैं रखता 2 order का element प्रिये ।

तब centre में मैं और तुम,

मैं playboy in the group प्रिये ।

तुम्हें समझना यूं आसान नहीं,

मैं residues का हूं सरल group प्रिये ।

अपनी bonding ऐसी जैसे,

मैं Dn का subgroup Zn प्रिये ।

तुम जैसी भी हो, कैसी भी हो,

मैं होता तुम में embedd प्रिये ।

तुम Dn सी Non Abelian हो,

मैं cyclic group का generator प्रिये ।

<div align="right">

–Mr. Abhay Srivastava

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3. Art work by Ms. Kanita
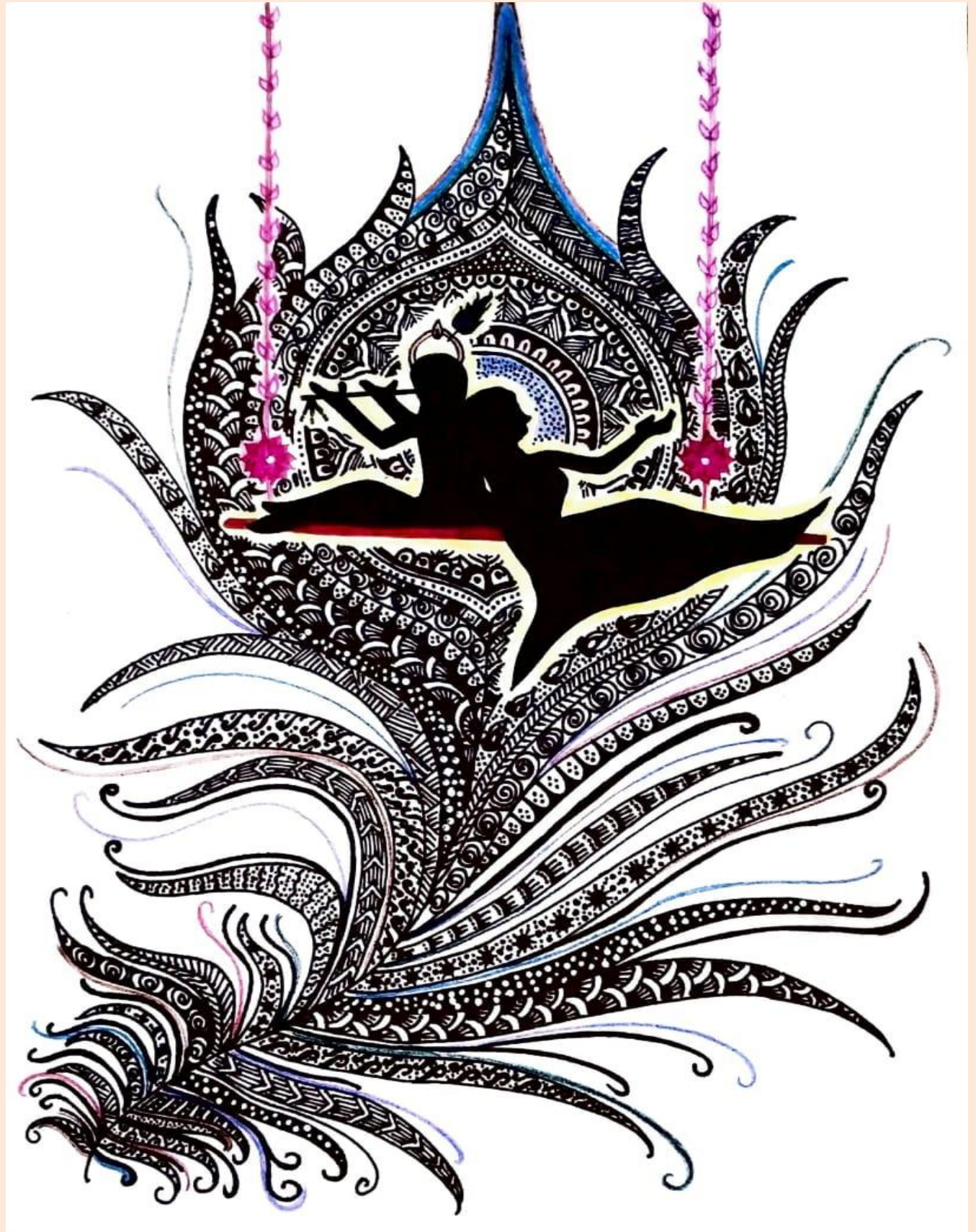
4. Ms. Anjali

Rock-Paper-Scissors: The Game Theory.

We've all played the *Rock-Paper-Scissors* game at least once in our lives. Consider your most recent game of Rock-Paper-Scissors. Did you succeed or fail?

"Shoushiling" appears to be a Chinese word? Yes, that is a different way to refer to rock-paper-scissors.

Let me share one instance from my everyday routine at home while on vacation.

As soon as the sound of the song "kude wala aaya ghar se kachra nikal" reached our home, my brother and I reacted impulsively with our hands to play the game. Of course whoever loses the game of rock-paper-scissors is gonna take the trash out.

If you guys have always believed that it is simply a game of luck and chance. I have bad news for you! No, It's not! Like most of the games either its "Chess" or "Ludo" It is also a game of strategy.

It is a simultaneous, zero-sum game and has three possible outcomes: Draw, Win or Loss.

The roots of the Rock-Paper-Scissors game originated in China just like Kanji, fireworks and the Coronavirus!

The game was originally mentioned by author Xie Zhaozhe's book "Wuzazu", who claimed that game's origins goes back to Han dynasty (206 BCE).

Mathematician *John Nash* proved "*In any game with a finite number of players and options like Rock-Paper-Scissors a mixture of strategies always exists where no single player can do any better by changing their own strategy alone*".

How do you avoid losing at Rock-Paper-Scissors?

Let's math it up and represent the game with the help of Payoff Matrix:

	BROTHER →		
MYSELF ↓	**ROCK**	**PAPER**	**SCISSORS**
ROCK	0, 0	-1, 1	1, -1
PAPER	1, -1	0, 0	-1, 1
SCISSORS	-1, 1	1, -1	0, 0

For any pure strategy like "Always choose Rock", a counter strategy can be adopted like "Always choose Paper," which will force another change in strategy.
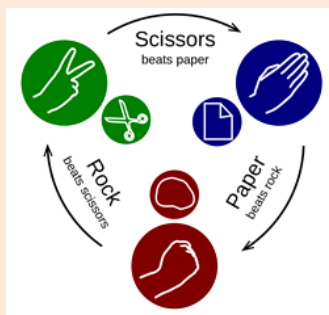
In this way, my brother and I will forever be chasing each other around the circle of strategies. Hence, this game doesn't have a Pure Strategy Nash equilibrium (PSNE).

My brother will definitely use a combination of methods once he's all grown up and learn some game theory.

Suppose I think there's a 1/2 chance that my brother will play Rock, 1/4 chance he'll play Paper, and 1/4 chance he'll play Scissors.

If I play Rock	U (expected payoff) = ½.(0) + ¼.(−1) + ¼ .(1) = 0
If I play Paper	U = ½ . (1) + ¼ . (0) + ¼ (−1) = 0.25
If I play Scissors	U = ½ .(−1) + ¼ .(1) + ¼ .(0) = −0.25

Hence, I should play Paper!

Now, what if I believe that there is a 1/3 chance that my brother will use each tactic?

No matter what I pick, my expected payoff is zero. Therefore, I am indifferent among all my options. Since there is 1/3 chance of each action so, any one of the three responses is equally best, I will prefer to pick one at random.

If both of us play with this strategy, neither can outperform the other on an average and neither will have any incentive to change their behavior.

Yay! we have reached the *Nash* equilibrium!

I win and my brother can learn Game Theory after putting the trash out!

Do we have another Nash Equilibrium…?
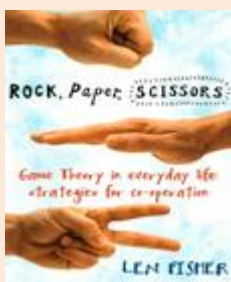
Hope you all like these brief fun facts about the game. If you are keen to know more, do give this book a try *"Rock, Paper, Scissors by Len Fisher: Game Theory in Everyday Life"*.

Ms. ANJALI