

Associate Professor

Department of Mathematics

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Also:

- [Convenor, IISc Mathematics Initiative](#)
- [Associate faculty, Department of Physics.](#)
- [Member, Analysis & Probability Research Group.](#)

Areas of Specialisation

1. Probability Theory
2. Combinatorics
3. Statistical Physics
4. Mathematical Physics
5. Experimental Mathematics

Employment

March 2018 – present	Associate Professor	Indian Institute of Science, Bangalore, India
July 2013 – March 2018	Assistant Professor	Indian Institute of Science, Bangalore, India
Sep 2010 – June 2013	Krener Assistant Professor	University of California, Davis.
Nov 2008 – Sep. 2010	Postdoctoral Research Scientist	Institut de Physique Théorique, CEA Saclay, France.

Education

Aug 2003 – Sep. 2008	Ph.D	Physics, Rutgers University, USA under the joint supervision of Joel L. Lebowitz and Doron Zeilberger titled <u>Statistical Mechanics and Combinatorics of Some Discrete Lattice Models</u> .
Aug 1998 – May 2003	Intg. M.Sc.	Physics, Indian Institute of Technology Kanpur, India.

Academic visits

Sep – Dec 2009	Invited Participant	Institut Henri Poincaré, Paris
June 2011	Aryabhata Visitor	Department of Theoretical Physics, TIFR, Mumbai, India.
Jan – May 2012	Research Member	MSRI, Berkeley, California.
Mar 2013	Invited Participant	ICERM, Brown University
Jan 2017	Invited Participant	Institut Henri Poincaré, Paris
Jan – April 2020	Invited Participant	Institut Mittag Leffler, Djursholm, Sweden.

Honors

1. *Associate of the Indian Academy of Sciences*, July 2014 – December 2017.
2. *Graduate Assistantship*, Department of Physics and Astronomy, Rutgers University, Fall 2006 to Summer 2008.
3. *Teaching Assistantship*, Department of Physics and Astronomy, Rutgers University, Fall 2003 to Spring 2006.
4. *General Proficiency Medal for best academic performance in Physics* for the Graduating Class of 2003, Indian Institute of Technology Kanpur Convocation, May 30, 2003.

Grants

1. SERB Core grant CRG/2021/001592 for the period 2022–2024.
2. *Royal Society Yusuf Hamied International Exchange Award* IES \R1 \191139 for the period September 2019 – August 2022 jointly with Sunil Chhita (Durham University, UK).
3. SERB Extramural grant EMR/2016/006624 for the period 2018–2020.
4. Indo-Swedish grant DST/INT/SWD/VR/P-01/2014 for the period 2014–2017 jointly with Svante Linusson (KTH, Stockholm).
5. *NSF Travel Grant*, to attend ICMP 2012 in August 2012.
6. *NSF Travel Grant*, to attend STATPHYS 23 in July 2007.

Workshops Organised

1. **Sage Days 114**, The Institute of Mathematical Sciences, Chennai, July 25–27, 2022.
2. **FPSAC 2022: The 34'th international conference on Formal Power Series and Algebraic Combinatorics**, Indian Institute of Science, Bangalore, July 18–22, 2022.
3. **Combinatorial Methods in Graph Theory**, Amrita University, Coimbatore, July 14–16, 2022.
4. **Combinatorial Algebraic Geometry: Tropical and Real**, ICTS Bangalore, June 27 – July 08, 2022.
5. **Combinatorics and algebras: From A(mitai Regev) to Z(eilberger, Doron)** (joint with R. Adin, A. Aizenbud, R. Dougherty-Bliss and Y. Roichman), virtual, July 26–29, 2021.
6. **Combinatorics and Random Processes** (joint with J. S. Kim and O. Mandelshtam) at Institut Mittag Leffler, Stockholm, Sweden, January 27–31, 2019.
7. **Universality in random structures: Interfaces, Matrices, Sandpiles** (joint with R. Basu and M. Krishnapur) at ICTS Bangalore, January 14 – February 8, 2019.

8. **Large deviation theory in statistical physics: Recent advances and future challenges** (joint with F. den Hollander, A. Dhar, J. P. Garrahan, C. Jarzynski, M. Krishnapur, A. Lelievre, S. Sabhapandit and H. Touchette) at ICTS Bangalore, August 14 – October 13, 2017.
9. **NCM Workshop on Probability and Representation Theory** (joint with A. Prasad and K. N. Raghavan), IMSc Chennai, March 7–12, 2016.
10. **UGC Workshop on Probability and Representation Theory** (joint with P. Singla and E. K. Narayanan), IISc Bangalore, March 16–17, 2015.
11. **Sage Days 60** (joint with A. Prasad and S. Viswanath), IMSc Chennai, August 14–17, 2014.

Graduate students supervised

Ph. D.

1. Dipankar Roy (jointly advised with Rahul Pandit, defended, January 2021)
Thesis title: *Steady state properties of discrete and continuous models of nonequilibrium phenomena*
Next position: Postdoctoral researcher at ICTS Bangalore
2. Subhajit Ghosh (defended, December 2020)
Thesis title: *Total variation cutoff for random walks on some finite groups*
Next position: Postdoctoral researcher at IIT Bombay
3. Nimisha Pahuja (ongoing)
4. Surjadipta De Sarkar (ongoing)
5. Nishu Kumari (ongoing)
6. Anita Arora (ongoing)

Masters

1. Himanshu Gupta (defended, June 2018)
Thesis title: *Correlation Functions in the Finite Toom Model*
Next position: Graduate student at University of Delaware

Postdoctoral researchers mentored

1. Hiranya Kishore Dey, May 2022 – (ongoing).
2. Shivani Goel, Apr. 2021 – (ongoing).
3. Sudip Bera, Apr. 2018 – June 2022.
Next position: Postdoctoral scientist at TIFR Bombay.
4. Arun Maiti, Feb – Sep. 2020.
Next position: Postdoctoral scientist at IIT Kharagpur.
5. Bikramaditya Sahu, Jan. 2019 – Mar. 2020.
Next position: Assistant Professor at NIT Rourkela from April, 2020.
6. Samrith Ram, Jan. – Sep. 2015.
Next position: Assistant Professor at IIIT Delhi.

Teaching Experience

1. UM 101, Analysis and Linear Algebra I (for UGs)
2. UM 201, Probability and Statistics (for UGs)
3. MA 361, Probability Theory
4. MA 318, Combinatorics
5. MA 261, Probability Models
6. MA 319, Algebraic Combinatorics
7. MA 386, Coxeter Groups
8. MA 216, Introduction to Graph Theory
9. (At UC Davis) Probability, Combinatorics and Calculus courses.

Publications

1. (with A. Sharan, R. Sharma, S. N. Sandhya and K. K. Sharma) Modeling absorption in saturable absorbers, *Optics Communications*, **199** (2001), no. 1-4, 267–275.
2. (with M. K. Verma, A. V. Chandra, O. Debliqy and S. Kumar) Local shell-to-shell energy transfer via nonlocal interactions in fluid turbulence, *Pramana*, **65** (2005), 297–310. <https://arxiv.org/abs/nlin/0204027>
3. (with M. K. Verma and A. V. Chandra) Energy transfer and locality in magnetohydrodynamic turbulence, *Phys. Plasmas*, **12** (2005), 082307, 7pp. <https://arxiv.org/abs/nlin/0308005>
4. (with T. Amdeberhan) Towards the moduli space of extended partial isometries, *preprint*, <https://arxiv.org/abs/hep-th/0508014>.
5. (with D. Zeilberger) The number of [old-time] basketball games with final score $n : n$ where the home team was never losing but also never ahead by more than w points, *Electronic J. of Combinatorics*, **14** (2007), no. 1, R19, 8pp. <https://arxiv.org/abs/math/0610734>
6. (with D. Zeilberger) Two dimensional directed lattice walks with boundaries, *Tapas in Experimental Mathematics*, Contemporary Mathematics **457**, edited by Tewodros Amdeberhan and Victor Moll, 1–19, (2007). <https://arxiv.org/abs/cond-mat/0701674>
7. (with M. Stenlund) Exponential decay of correlations for randomly chosen hyperbolic toral automorphisms, *Chaos*, **17** (2007), 043116, 7pp. <https://arxiv.org/abs/0704.1495>
8. The half-perimeter generating function of gated and wicketed Ferrers diagrams, *Journal of Integer Sequences*, **10** (2007), no. 10, 07.10.3, 11pp. <https://arxiv.org/abs/0710.5133>
9. Towards a human proof of Gessel’s conjecture, *Journal of Integer Sequences*, **12** (2007), no. 4, 09.4.2, 15pp. <https://arxiv.org/abs/0902.2329>
10. (with D. Zeilberger) A bijectional attack on the Razumov-Stroganov conjecture, *The Personal Journal of Shalosh B. Ekhad and Doron Zeilberger*, appeared Dec 2, 2008, <https://arxiv.org/abs/0812.0447>.
11. (with C. Liverani and M. Stenlund) Quenched CLT for random toral automorphisms, *Discrete and Continuous Dynamical Systems, A*, **24** (2009) no. 2, 331–348. <https://arxiv.org/abs/0711.3818>

12. (with J. L. Lebowitz and E. R. Speer) On the asymmetric exclusion process with semi-permeable boundaries, *Journal of Statistical Physics*, **135** (2009), no. 5–6, 1009–1037. <https://arxiv.org/abs/0807.2423>
13. (with E. A. Carlen, J. L. Lebowitz, P. K. Mohanty, D. Mukamel and E. R. Speer) Phase diagram of the ABC model on an interval, *Journal of Statistical Physics*, **137** (2009), no. 5–6, 1166–1204, [Erratum: *Journal of Statistical Physics*, **144** (2011), no. 4, 920–921]. <https://arxiv.org/abs/0905.4849>
14. (with K. Mallick) Exact results for an asymmetric annihilation process with open boundaries, *J. Phys. A: Math. Theor.*, **43** (2010), 045003, 22pp. <https://arxiv.org/abs/0910.0693>
15. A natural bijection between permutations and a family of descending plane partitions, *European Journal of Combinatorics*, **31** (2010) no. 7, 1785–1791. <https://arxiv.org/abs/0909.4732>
16. Algebraic properties of a disordered asymmetric Glauber model, *J. Stat. Mech.*, **2011** (2011), P02034, 17pp. <https://arxiv.org/abs/1012.0875>
17. (with C. Arita, S. Prolhac and K. Mallick) Recursive structures in the multispecies ASEP, *J. Phys. A: Math. Theor.*, **44** (2011), 335004, 26pp. <https://arxiv.org/abs/1104.3752>
18. (with R. Cori and D. Gouyou-Beauchamps) Monotone triangles and 312 pattern avoidance, *Electronic J. of Combinatorics*, **18** no. 2 (2011), no. 2, P26, 22pp. <https://arxiv.org/abs/1101.1666>
19. (with J. L. Lebowitz and E. R. Speer) On some classes of open two species exclusion processes, *Markov Processes and Related Fields*, **18** (2012), 157–176. <https://arxiv.org/abs/1008.4721>
20. (with C. Arita, S. Prolhac and K. Mallick) Generalized matrix Ansatz in the multispecies exclusion process - partially asymmetric case, *J. Phys. A: Math. Theor.*, **45** (2012), 195001, 16pp. <https://arxiv.org/abs/1201.0388>
21. Determinants and perfect matchings, *Journal of Combinatorial Theory, Series A*, **120** no. 1 (2013), 304–314. <https://arxiv.org/abs/1106.1465>
22. (with D. Romik) New enumeration formulas for alternating sign matrices and square ice partition functions, *Advances in Math*, **235** (2013), 161–186. <https://arxiv.org/abs/1202.3651>
23. (with V. Strehl) Stationary distribution and eigenvalues for a de Bruijn Process, *Advances in Combinatorics, Waterloo Workshop in Computer Algebra*,

- W80, May 26-29, 2011, Kotsireas, Ilias S and Zima, Eugene V. (Eds.), (2013) 101–120. <https://arxiv.org/abs/1108.5695>
24. (with S. Linusson) An inhomogeneous multispecies TASEP on a ring, *Advances in Applied Mathematics*, **57** (2014) 21–43. <https://arxiv.org/abs/1206.0316>
 25. (with S. Klee and A. Schilling) Combinatorial Markov chains on linear extensions, *Journal of Algebraic Combinatorics*, **39** no. 4 (2014) 853–881. <https://arxiv.org/abs/1205.7074>
 26. (with S. Klee and A. Schilling) Markov chains for promotion operators, *Algebraic Monoids, Group Embeddings, and Algebraic Combinatorics*, Fields Institute Communications, **71** (2014), 285–304. <https://arxiv.org/abs/1307.7499>
 27. (with Priyanka and K. Jain) Two-point correlation function of an exclusion process with hole-dependent rates, *Phys. Rev. E*, **90** no. 6 (2014) 062104, 10pp. <https://arxiv.org/abs/1407.1631>
 28. (with A. Schilling, N. M. Thiéry and B. Steinberg) Directed nonabelian sandpile models on trees, *Communications in Mathematical Physics*, **335** no. 3 (2015), 1065–1098. <https://arxiv.org/abs/1305.1697>
 29. (with A. Schilling, N. M. Thiéry and B. Steinberg) Markov chains, \mathcal{R} -trivial monoids and representation theory, *International Journal of Algebra and Computation*, **25** Issue 1 no. 2 (2015), 169–231. <https://arxiv.org/abs/1401.4250>
 30. (with J. Bouttier, S. Corteel and F. Nunzi) Multivariate juggling probabilities, *Electronic Journal of Probability*, **20** no. 5 (2015), 1–29. <https://arxiv.org/abs/1402.3752>
 31. A statistical model of current loops and magnetic monopoles, *Mathematical Physics, Analysis and Geometry*, **18** no. 1 (2015), 16, 19pp. <https://arxiv.org/abs/1311.5965>
 32. (with J. Bouttier, S. Linusson and F. Nunzi) Some generalized juggling processes, *DMTCS Proceedings, 27nd International Conference on Formal Power Series and Algebraic Combinatorics (FPSAC, 2015)*, **FPSAC '15** (2015), 925–936.
 33. A finite variant of the Toom model, *Journal of Physics: Conference Series*, **638** (2015), 012005, 9pp. <https://arxiv.org/abs/1503.00086>

34. (with A. Prasad and S. Spallone) Odd partitions in Young's lattice, *Séminaire Lotharingien de Combinatoire* **75** (2015), B75g, 13 pp. <https://arxiv.org/abs/1601.01776>
35. Full current statistics for a disordered open exclusion process, *J. Phys. A: Math. Theor.*, **49** no. 15 (2016), 155003, 10pp. <https://arxiv.org/abs/1512.01057>
36. (with S. Linusson) Correlations in the multispecies TASEP and a conjecture by Lam, *Transactions of the AMS* **369** (2017), 1097–1125. <https://arxiv.org/abs/1404.6679>
37. (with A. Schilling and N. M. Thiéry) Spectral gap for random-to-random shuffling on linear extensions, *Experimental Mathematics* **26** (2017), 22–30. <https://arxiv.org/abs/1412.7488>
38. (with A. Prasad and S. Spallone) Representations of symmetric groups with non-trivial determinant, *Journal of Combinatorial Theory, Series A*, **150** (2017) 208–232. <https://arxiv.org/abs/1604.08837>
39. (with D. Roy) The exact phase diagram for a class of multispecies asymmetric exclusion processes, *Scientific Reports*, **7** (2017), 13555, 8pp <https://arxiv.org/abs/1611.01943>
40. (with C. Finn and D. Roy) Matrix product solution of a left-permeable two-species asymmetric exclusion process, *Phys. Rev. E*, **97** no. 1 (2018) 012151, 10pp. <https://arxiv.org/abs/1708.09153>
41. (with J. Bouttier, S. Corteel, S. Linusson and F. Nunzi) Bumping sequences and multispecies juggling, *Advances in Applied Mathematics*, **98** (2018) 100–126. <https://arxiv.org/abs/1504.02688>
42. (with S. Ramassamy) The Hilbert-Galton board, *Latin American Journal of Probability and Mathematical Statistics (ALEA)*, **15** no. 2 (2018), 755–774. <https://arxiv.org/abs/1711.08525>
43. (with C. Finn and D. Roy) The phase diagram for a multispecies left-permeable asymmetric exclusion process, *Journal of Statistical Physics*, **174** no. 3 (2019), 605–621. <https://arxiv.org/abs/1808.05807>.
44. (with R. E. Behrend) Factorization theorems for classical group characters, with applications to alternating sign matrices and plane partitions, *Journal of Combinatorial Theory, Series A*, **165** (2019), 78–105. <https://arxiv.org/abs/1804.04514>.

45. (with S. Linusson) Reverse juggling processes, *Random Structures & Algorithms*, **55** no. 1 (2019), 56–72. <https://arxiv.org/abs/1706.03956>.
46. (with E. Aas, S. Linusson and S. Potka) The exact phase diagram for a semipermeable TASEP with nonlocal boundary jumps, *J. Phys. A: Math. Theor.*, **52** no. 35 (2019), 355001, 19pp. <https://arxiv.org/abs/1902.02019>.
47. (with A. Prasad and S. Spallone) Macdonald trees and determinants of representations for finite Coxeter groups, *Indian Journal of Discrete Mathematics*, **5** no. 1 (2019) 1–22, <https://arxiv.org/abs/1812.00608>.
48. (with I. Fischer) Bijective proofs of skew Schur polynomial factorizations, *Journal of Combinatorial Theory, Series A*, **174** (2020), 105241, 40pp. <https://arxiv.org/abs/1905.05226>.
49. (with P. Singla) Random motion on finite rings, I: commutative rings, *Algebras and Representation Theory*, **23** (2020), 583–604. <https://arxiv.org/abs/1605.05089>.
50. Squareness for the monopole-dimer model, *Annals of Combinatorics*, **24** (2020), 237–255. <https://arxiv.org/abs/1608.03151>.
51. (with M. Josuat-Vergès and S. Ramassamy) Extensions of partial cyclic orders and consecutive coordinate polytopes, *Annales Henri Lebesgue*, **3** (2020) 275–297, <https://arxiv.org/abs/1803.10351>.
52. (with B. Steinberg) Random walks on rings and modules, *Algebraic Combinatorics*, **3** no. 2 (2020) 309–329, <https://arxiv.org/abs/1708.04223>.
53. (with R. E. Behrend and I. Fischer) Extreme diagonally and antidiagonally symmetric alternating sign matrices of odd order, *Advances in Mathematics*, **367** (2020) 107125, 56pp, <https://arxiv.org/abs/1611.03823>.
54. (with S. Chhita) Correlations in totally symmetric self-complementary plane partitions, *Transactions of the London Mathematical Society*, **8** no. 1, (2021) 493–526, <https://arxiv.org/abs/2012.12623>.
55. (with B. Bényi) Toppling on permutations with an extra chip, *Electronic J. of Combinatorics*, **28** no. 4, (2021) P4.18, 28pp, <https://arxiv.org/abs/2104.13654>.
56. (with N. Bhatnagar) The number of inversions of permutations with fixed shape, *Journal of Enumerative Combinatorics*, **2** no. 4, (2022) S4PP1, 14pp, <https://arxiv.org/abs/1712.10122>.

57. (with E. Aas, S. Linusson and S. Potka) Limiting directions for random walks in classical affine Weyl groups, *International Mathematics Research Notices*, to appear, <https://arxiv.org/abs/2004.13399>.
58. (with P. Nadeau) Combinatorics of a disordered two-species ASEP on a torus, *European Journal of Combinatorics*, **103** (2022) 103511, 20pp, <https://arxiv.org/abs/2104.02448>.
59. (with D. Hathcock and P. Tetali) Toppleable Permutations, Excedances and Acyclic Orientations, *Combinatorial Theory*, **2** no. 1, (2022) Article 10, 28pp, <https://arxiv.org/abs/2010.11236>.
60. A simple symmetric exclusion process driven by an asymmetric tracer particle, *Annales de l'Institut Henri Poincaré D*, to appear, <https://arxiv.org/abs/2001.02425>.
61. (with S. Sinha) The size of t -cores and hook lengths of random cells in random partitions, *Annals of Applied Probability*, to appear, <https://arxiv.org/abs/1911.03135>.
62. (with S. Goldstein, J. L. Lebowitz and E. R. Speer) Stationary States of the One-dimensional Facilitated Asymmetric Exclusion Process, *Annales de l'Institut Henri Poincaré, Probabilités et Statistiques*, to appear, <https://arxiv.org/abs/2010.07257>.
63. (with P. Singla) Random motion on finite rings, II: Noncommutative rings, *submitted*, <https://arxiv.org/abs/1807.04082>.
64. (with O. Mandelshtam and J. Martin) Stationary probabilities of the multi-species TAZRP and modified Macdonald polynomials: I, *submitted*, <https://arxiv.org/abs/2011.06117>.
65. (with S. Chhita and K. Johansson) GOE fluctuations for the maximum of the top path in alternating sign matrices, *submitted*, <https://arxiv.org/abs/2109.02422>.
66. (with N. Kumari) Factorization of classical characters twisted by roots of unity, *submitted*, <http://arxiv.org/abs/2109.11310>.
67. (with N. Sundaravaradan) Combinatorial proofs of multivariate Cayley–Hamilton theorems, *submitted*, <http://arxiv.org/abs/2110.03992>.
68. (with A. Arora) The monopole-dimer model on Cartesian products of plane graphs, *submitted*, <http://arxiv.org/abs/2205.11791>.

Conference publications

1. (with V. Strehl) The spectrum of an asymmetric annihilation process, *DMTCS Proceedings, 22nd International Conference on Formal Power Series and Algebraic Combinatorics (FPSAC, 2010)*, (2010), 461–472.
2. (with J. Bouttier, S. Corteel and F. Nunzi) Multivariate juggling probabilities, *DMTCS Proceedings, 25th International Conference on Probabilistic, Combinatorial and Asymptotic Methods for the Analysis of Algorithms (AofA 2014)*, (2014) 1–12.
3. (with J. Bouttier, S. Linusson and F. Nunzi) Some generalized juggling processes, *DMTCS Proceedings, 27th International Conference on Formal Power Series and Algebraic Combinatorics (FPSAC, 2015)*, (2015), 925–936.
4. (with S. Sinha) The size of t -cores and hook lengths in random partitions, *Séminaire Lotharingien de Combinatoire, Proceedings of the 32nd International Conference on Formal Power Series and Algebraic Combinatorics (FPSAC, 2020)*, **84B** (2020), Art. 58, 11 pp.
5. (with O. Mandelshtam and J. Martin) Multispecies TAZRP and modified Macdonald polynomials, *Séminaire Lotharingien de Combinatoire, Proceedings of the 33rd International Conference on Formal Power Series and Algebraic Combinatorics (FPSAC, 2021)*, **85B** (2021), Art. 56, 12 pp.

General articles

1. (with B. Sury) John Horton Conway: The Magical Genius Who Loved Games, *Resonance*, **26** (2021), 595–601.

Professional Service

1. Associate editor, *Indian Journal of Pure and Applied Mathematics* since November 2019.
2. Editorial board member for *Algebraic Combinatorics* since April, 2020.
3. Editorial board member of *Resonance* for the period January 2021 to December 2023.

4. Editorial board member of *Proceedings – Mathematical Sciences* for the period January 2021 to December 2023.
5. Referee for selected mathematics journals:
 - (a) [AMS MathSciNet Mathematical Reviews](#) (Reviews of published work)
 - (b) [Zentralblatt MATH](#) (Reviews of published work)
 - (c) Annales de l’Institut Henri Poincaré, Probabilités et Statistiques
 - (d) Pacific Journal of Mathematics
 - (e) Advances in Applied Mathematics
 - (f) Electronic Journal of Combinatorics
 - (g) European Journal of Combinatorics
 - (h) Algebraic Combinatorics
 - (i) Discrete Mathematics
 - (j) Annals of Combinatorics
 - (k) Linear and Multilinear Algebra
6. Referee for selected physics journals:
 - (a) Journal of Statistical Physics
 - (b) Journal of Physics A
 - (c) Journal of Statistical Mechanics
 - (d) Scientific Reports
 - (e) Modern Physics Letters B
7. Referee for conference proceedings:
 - (a) Formal Power Series and Algebraic Combinatorics (FPSAC)
 - (b) ACM-SIAM Symposium on Discrete Algorithms (SODA)
8. [Contributor](#) to the [Online Encyclopaedia of Integer Sequences](#).
9. Contributor to [Sage Mathematical Software](#).
10. Member of the Institute Website & Publications Committee, IISc.
11. Coordinator of the UG Mathematics programme, IISc.
12. Committee Member, Office of International Relations, IISc
13. Member of the Computer Committee, Department of Mathematics, IISc, 2016–2022.

Personal Information

1. Date of Birth: July 6, 1980.
2. Citizen of India.
3. Human Languages - English, Hindi, Tamil, Gujarati, French.
4. Computer Languages - C, Python, L^AT_EX, Maple, Mathematica, Sage.