

## ABOUT US

Department of Mathematics is one of the basic science departments at IIT DELHI. Students with a commitment to pursuing research and career in pure, applied mathematics, and scientific computing for making a better future. They are groomed under apt academic rigor which enables them to acquire skills to form efficient solutions for the problems of industry and academics.



## PROGRAMS

B.TECH IN MATHEMATICS & COMPUTING

B.TECH & M.TECH IN MATHEMATICS &  
COMPUTING

M.Sc. IN MATHEMATICS

PhD in PURE and APPLIED  
MATHEMATICS



PLACEMENT BROCHURE 2020-21

MATHEMATICS DEPARTMENT

INDIAN INSTITUTE OF TECHNOLOGY  
DELHI

## AREAS OF RESEARCH

- ALGEBRA
- ALGORITHMS AND GRAPH THEORY
- APPLIED PROBABILITY
- COMBINATORIAL TOPOLOGY
- DYNAMICAL SYSTEMS AND FRACTALS
- FINANCIAL MATHEMATICS
- GAME THEORY
- HARMONIC ANALYSIS
- MACHINE TRANSLATION & ARTIFICIAL INTELLIGENCE
- NUMBER THEORY AND CRYPTOGRAPHY
- NUMERICAL ANALYSIS
- NUMERICAL LINEAR ALGEBRA
- OPTIMIZATION
- PARALLEL COMPUTING
- PARTIAL DIFFERENTIAL EQUATIONS
- STOCHASTIC MODELS

## RESEARCH FACILITIES

### SOFTWARES



- MODELICA
- MATLAB
- AXIOM
- MAXIMA
- GAMBIT
- MATHBUNTU
- SAGEMATH
- SCILAB

### LAB



- VLSI Design and Tools Lab
- Data Analytics Lab

## COURSES OFFERED

### CORE

- ABSTRACT ALGEBRA
- LINEAR ALGEBRA AND APPLICATIONS
- COMPUTATIONAL METHODS IN DIFFERENTIAL EQUATIONS
- NUMERICAL ANALYSIS
- OPTIMIZATION
- REAL & COMPLEX ANALYSIS
- ADVANCED DESIGN OF ALGORITHMS
- STOCHASTIC PROCESSES
- THEORY OF COMPUTATION
- FUNCTIONAL ANALYSIS
- MULTIVARIATE AND STATISTICAL METHODS

### ELECTIVES

NUMBER THEORY  
COMBINATORICS  
NUMERICAL OPTIMIZATION  
NEUROCOMPUTING  
CRYPTOGRAPHY  
FINANCIAL MATHEMATICS  
FRACTAL GEOMETRY  
PARALLEL ALGORITHMS  
STOCHASTIC OF FINANCE  
GRAPH THEORY  
ALGEBRAIC CODING THEORY  
GAME THEORY

## ONGOING PROJECTS

| Name of the Investigator | Title of the project and duration  | Amount sanctioned (in lakhs) | Funding Agency                                  |
|--------------------------|--|------------------------------|---|
| N. Chatterjee            | Development of Predictive Data Analysis System using <b>Artificial intelligence</b>                      | 150                          | <b>DGGI, Ministry of Finance, Govt of India</b> |
| Vikas Vikram Singh       | Games and Optimization for Energy Management with Stochasticity- GOEMS                                   | 19.08                        | <b>Indo-French project by DST-CNRS</b>          |
| Vikas Vikram Singh       | <b>Modelling and validation of dinucleotids in the human genome</b>                                      | 5                            | <b>FIRP 2019, IIT Delhi</b>                     |
| Mani Mehra               | <b>Wavelet methods for PDEs on network</b>   | 6.6                          | <b>DST-SERB, India</b>                          |
| Mani Mehra               | <b>Multiscale Modeling, Simulation and Optimization for Energy, Advanced Materials and Manufacturing</b> | 280                          | <b>Indo-German Partnership(IGP), India</b>      |
| S. Dharmaraja            | Valuing Variable Annuities with Lifelong Guarantees Valuing Variable Annuities with Lifelong Guarantees  | 6.6                          | <b>DST-SERB, India</b>                          |
| S. Dharmaraja            | Performance and Dependability Analysis and Development of Testbed of 5G Networks                         | 43.04                        | <b>DoT</b>                                      |

|                       |   |          |                             |
|-----------------------|---|----------|-----------------------------|
| K. Sreenadh           | <b>Existence and multiplicity results for nonlocal elliptic and parabolic problems</b>                  | 6.60     | <b>DST-SERB, India</b>      |
| HOD (Mathematics)     | DST-FIST project, Computational Lab for Mathematics, 2020-2023  | 55.0     | <b>DST-FIST</b>             |
| Sivananthan Sampath   | <b>Average and Relevant Sampling in Reproducing Kernel subspace of Mixed Lebesgue Space</b>             | 28.79888 | <b>DST, India</b>           |
| Ananta Majee          | <b>Indo-French project: Evolutionary PDEs: degeneracy, noise and approximations, 2018-2021 (co PI).</b> | 60.5     | <b>IFCAM(Indo- French)</b>  |
| Prof. Biplab Basak    | India Development Fund (IDF)' of budget AUD 9,970   | 4.8      | <b>University of Sydney</b> |
| Prof. N Shravan Kumar | Fourier algebras on ultraspherical hypergroups  | 6.6      | <b>DST-SERB</b>             |
| Prof. Harish Kumar    | Stable Numerical Schemes for Relativistic Fluid and Plasma Flows  | 6.6      | <b>DST-SERB</b>             |

|                          |   |       |                 |
|--------------------------|---|-------|-----------------|
| Prof. Surjeet Kour       | Image of locally finite and locally nilpotent derivations over the polynomial algebra               | 6.6   | <b>DST-SERB</b> |
| Prof. Aparajita Dasgupta | Pseudo-differential Calculus on the Affine Group  | 6.6   | <b>DST-SERB</b> |
| Prof. Aparajita Dasgupta | Functional Classes and Hyperbolic equations on Hilbert Spaces                                       | 27.86 | <b>DST-SERB</b> |
| Prof. Ritumoni Sarma     | Study of new types of continued fractions and applications  | 6.6   | <b>DST-SERB</b> |
| Prof. B. S.Panda         | Mathching and Its Variations: Structural and Algorithmic Study                                      | 6.6   | <b>DST-SERB</b> |
| Prof. Kamana Porwal      | Pointwise A Posteriori Error Estimates For Finite Element Methods For The Elliptic Obstacle Problem | 6.6   | <b>DST-SERB</b> |
| Prof. Kamana Porwal      | Finite element methods for the variational inequalities of the second kind                          | 15.16 | <b>DST-SERB</b> |

**Department of Mathematics  
Research Publications in 2019**

**International Journals**

1. Arora, R.; Giacomoni, J.; Mukherjee, T.; Sreenadh, K., n-Kirchhoff-Choquard equations with exponential nonlinearity. *Nonlinear Anal.* 186 (2019), 113–144.
2. Awasthi, Ambrish; Sharma, Rajendra K., Primitive transformation shift registers over finite fields. *J. Algebra Appl.* 18 (2019), no. 9, 1950171, 16 pp.
3. Banerjee, Abhishek; Kour, Surjeet,  $(A, \delta)$ -modules, Hochschild homology and higher derivations. *Ann. Mat. Pura Appl.* (4) 198 (2019), no. 5, 1781–1802.
4. Basak, Biplab, Regular genus and gem-complexity of some mapping tori. *Rev. R. Acad. Cienc. Exactas Fís. Nat. Ser. A Mat. RACSAM* 113 (2019), no. 3, 2479–2493.
5. Pooja Bansal, Aparna Mehra, Directional distance function based super efficiency integer dynamic data envelopment analysis model, *Data Envelopment Analysis Journal*, 4 (2), 149– 186, 2019.
6. Batra, Sanjit Singh; Kumar, Nikhil; Tripathi, Amitabha, Some problems concerning the Frobenius number for extensions of an arithmetic progression. *Ramanujan J.* 48 (2019), no. 3, 545–565.
7. Levin, David; Dyn, Nira; Viswanathan, Puthan Veedu, Non-stationary versions of fixed-point theory, with applications to fractals and subdivision. *J. Fixed Point Theory Appl.* 21 (2019), no. 1, Art. 26, 25 pp.
8. Dhara, B.; Garg, C.; Sharma, R. K., An identity on generalized derivations involving multilinear polynomials in prime rings. *Proc. Indian Acad. Sci. Math. Sci.* 129 (2019), no. 3, Art. 40, 14 pp.
9. S. Dharmaraja, Vineet Kumar and Abhishek Mishra, Indian Stock Market Prediction using Artificial Neural Networks on Tick Data, *Financial Innovation*, 5 (2019) 16 pages.
10. Cardona, Duván; Kumar, Vishvesh, Lp-boundedness and Lp-nuclearity of multilinear pseudo-differential operators on  $Z_n$  and the torus  $T^n$ . *J. Fourier Anal. Appl.* 25 (2019), no. 6, 2973–3017.
11. Dunst, Thomas; Majee, Ananta K.; Prohl, Andreas; Vallet, Guy, On stochastic optimal control in ferromagnetism. *Arch. Ration. Mech. Anal.* 233 (2019), no. 3, 1383–1440.
12. Figueroa-García, Juan Carlos; Mehra, Aparna; Chandra, Suresh, Optimal solutions for group matrix games involving interval-valued fuzzy numbers. *Fuzzy Sets and Systems* 362 (2019), 55–70.
13. Giacomoni, Jacques; Mukherjee, Tuhina; Sreenadh, Konijeti, Existence and stabilization results for a singular parabolic equation involving the fractional Laplacian. *Discrete Contin. Dyn. Syst. Ser. S* 12 (2019), no. 2, 311–337.
14. Giacomoni, Jacques; Mukherjee, Tuhina; Sreenadh, Konijeti, Existence of three positive solutions for a nonlocal singular Dirichlet boundary problem. *Adv. Nonlinear Stud.* 19 (2019), no. 2, 333–352.
15. Giacomoni, Jacques; Mukherjee, Tuhina; Sreenadh, Konijeti, A global multiplicity result for a very singular critical nonlocal equation. *Topol. Methods Nonlinear Anal.* 54 (2019), no. 1, 345–370.

16. Goel, Anubha; Aparna Mehra, Analyzing contagion effect in markets during financial crisis using stochastic autoregressive canonical vine model, *Computational Economics*, 53 (3), 921 - 950, 2019.
17. Goel, Anubha; Sharma, Amita; Mehra, Aparna, Robust optimization of mixed CVaR STARR ratio using copulas. *J. Comput. Appl. Math.* 347 (2019), 62–83.
18. Goel, Divya; Sreenadh, K., On the second eigenvalue of combination between local and nonlocal p-Laplacian. *Proc. Amer. Math. Soc.* 147 (2019), no. 10, 4315–4327.
19. Goel, Divya; Sreenadh, K., Kirchoff equations with Hardy-Littlewood-Sobolev critical nonlinearity. *Nonlinear Anal.* 186 (2019), 162–186.
20. Gautam, Anupam; S. Dharmaraja, Selection of DRX scheme for voice traffic in LTE-A networks: Markov modeling and performance analysis. *J. Ind. Manag. Optim.* 15 (2019), no. 2, 739–756.
21. Guglielmo D'Amico, S. Dharmaraja, Raimondo Manca and Puneet Pasricha: A Review of Non-Markovian Models for the Dynamics of Credit Ratings, *Reports on Economics and Finance*, 5 (2019) pp. 15 - 33.
22. Kartikay Gupta, Aayushi Khajuria, Niladri Chatterjee, Pradeep Joshi, Deepak Joshi, Rule Based Classification of Neurodegenerative Diseases using Data Driven Gait Features. *Health and Technology*, 9, (2019) 547–560.
23. Jensen, Max; Majee, Ananta K.; Prohl, Andreas; Schellnegger, Christian, Dynamic programming for finite ensembles of nanomagnetic particles. *J. Sci. Comput.* 80 (2019), no. 1, 351–375.
24. Kanwar, Pramod; Khatkar, Meenu; Sharma, R. K., On Leavitt path algebras over commutative rings. *Int. Electron. J. Algebra* 26 (2019), 191–203.
25. Kapoor, Shruti; S. Dharmaraja; Arunachalam, Viswanathan, Transient solution of fluid queue modulated by two independent birth-death processes. *Int. J. Oper. Res.* 36 (2019), no. 1, 1–11.
26. Kour, Surjeet, On n-th class preserving automorphisms of n-isoclinism family. *Proc. Indian Acad. Sci. Math. Sci.* 129 (2019), no. 1, Art. 8, 8 pp.
27. Kumar, Dileep; Chaudhary, Sudhakar; Kumar, V. V. K. Srinivas, Finite element analysis for coupled time-fractional nonlinear diffusion system. *Comput. Math. Appl.* 78 (2019), no. 6, 1919–1936.
28. Kumar, Dileep; Chaudhary, Sudhakar; Srinivas Kumar, V. V. K., Fractional Crank-Nicolson-Galerkin finite element scheme for the time-fractional nonlinear diffusion equation. *Numer. Methods Partial Differential Equations* 35 (2019), no. 6, 2056–2075.
29. Kumar, Dileep; Chaudhary, Sudhakar; Kumar, V. V. K. Srinivas, Galerkin finite element schemes with fractional Crank-Nicolson method for the coupled time-fractional nonlinear diffusion system. *Comput. Appl. Math.* 38 (2019), no. 3, Art. 123, 29 pp.
30. Kumar, Vishvesh; Kumar, N. Shravan, Vector valued Fourier analysis on hypergroups. *Oper. Matrices* 13 (2019), no. 4, 1147–1161.
31. Kumar, Vishvesh; Kumar, N. Shravan; Sarma, Ritumoni, Unbounded translation invariant operators on commutative hypergroups. *Methods Funct. Anal. Topology* 25 (2019), no. 3, 236–247.
32. Kumar, Vishvesh; Sarma, Ritumoni; Kumar, N. Shravan, Orlicz spaces on hypergroups. *Publ. Math. Debrecen* 94 (2019), no. 1-2, 31–47.
33. Kumar, Vishvesh, Pseudo-differential operators on homogeneous spaces of compact and Hausdorff groups. *Forum Math.* 31 (2019), no. 2, 275–282.



34. Kumar, Vishvesh; Wong, M. W.,  $C^*$ -algebras,  $H^*$ -algebras and trace ideals of pseudo-differential operators on locally compact, Hausdorff and abelian groups. *J. Pseudo-Differ. Oper. Appl.* 10 (2019), no. 2, 269–283.
35. Kumar, Vishvesh; Ross, Kenneth A.; Singh, Ajit Iqbal, Hypergroup deformations of semigroups. *Semigroup Forum* 99 (2019), no. 1, 169–195.
36. Lal, Rattan; Kumar, N. Shraavan, Orlicz Figà-Talamanca Herz algebras and invariant means. *Indag. Math. (N.S.)* 30 (2019), no. 2, 340–354.
37. Maheshwari, Swati; Sharma, R. K., A note on presentation of general linear groups over a finite field. *Southeast Asian Bull. Math.* 43 (2019), no. 2, 217–224.
38. Meena, Asha Kumari; Kumar, Harish, Robust numerical schemes for two-fluid ten-moment plasma flow equations. *Z. Angew. Math. Phys.* 70 (2019), no. 1, Art. 23, 30 pp.
39. Mehandiratta, Vaibhav; Mehra, Mani; Leugering, Günter, Existence and uniqueness results for a nonlinear Caputo fractional boundary value problem on a star graph. *J. Math. Anal. Appl.* 477 (2019), no. 2, 1243–1264.
40. Mukherjee, Tuhina; Sreenadh, Konijeti, On Dirichlet problem for fractional  $p$ -Laplacian with singular non-linearity. *Adv. Nonlinear Anal.* 8 (2019), no. 1, 52–72.
41. Rajashekar, Naraveni; Chaudhary, Sudhakar; Srinivas Kumar, V. V. K., Approximation of  $p$ -biharmonic problem using WEB-spline based mesh-free method. *Int. J. Nonlinear Sci. Numer. Simul.* 20 (2019), no. 6, 703–712.
42. Navascués, M. A.; Viswanathan, P., Energy minimizing associate fractal functions. *Rev. R. Acad. Cienc. Exactas Fís. Nat. Ser. A Mat. RACSAM* 113 (2019), no. 2, 1025–1039.
43. Gillis, Nicolas; Karow, Michael; Sharma, Punit, Approximating the nearest stable discrete-time system. *Linear Algebra Appl.* 573 (2019), 37–53.
44. Panda, B. S.; Verma, Shaily, On partial Grundy coloring of bipartite graphs and chordal graphs. *Discrete Appl. Math.* 271 (2019), 171–183.
45. Pandey, Arti; Panda, B. S., Domination in some subclasses of bipartite graphs. *Discrete Appl. Math.* 252 (2019), 51–66.
46. Pasricha, Puneet; S. Dharmaraja, A Markov modulated dynamic contagion process with application to credit risk. *J. Stat. Phys.* 175 (2019), no. 2, 495–511.
47. Pasricha, Puneet; Goel, Anubha, Pricing vulnerable power exchange options in an intensity based framework. *J. Comput. Appl. Math.* 355 (2019), 106–115.
48. Patel, Kuldip Singh; Mehra, Mani, High-order compact finite difference scheme for pricing Asian option with moving boundary condition. *Differ. Equ. Dyn. Syst.* 27 (2019), no. 1-3, 39–56.
49. Patra, Suchismita; Chaudhary, Sudhakar; Srinivas Kumar, V. V. K., Approximation of the first eigenpair of the  $p$ -Laplace operator using WEB-spline based finite element method. *Eng. Anal. Bound. Elem.* 104 (2019), 277–287.
50. Pradhan, D.; Panda, B. S., Computing a minimum paired-dominating set in strongly orderable graphs. *Discrete Appl. Math.* 253 (2019), 37–50.
51. Radha, R.; Sarvesh, K.; Sivanathan, S., Sampling and reconstruction in a shift invariant space with multiple generators. *Numer. Funct. Anal. Optim.* 40 (2019), no. 4, 365–385.
52. Rao, S. Chandra Sekhara; Chawla, Sheetal, Parameter-uniform convergence of a numerical method for a coupled system of singularly perturbed semilinear reaction-diffusion equations with boundary and interior layers. *J. Comput. Appl. Math.* 352 (2019), 223–239.

53. S. Ramakrishnan, Subrat Kar and S. Dharmaraja,: Analysis of energy efficiency in cloud based heterogeneous RAN with large-scale antenna systems, *Computer Networks*, 149 (2019) pp. 265–276.
54. S. Ramakrishnan, Subrat Kar and S. Dharmaraja,: Analysis of Traffic Offload using Multi Attribute Decision Making Technique in Heterogeneous Shared Networks, *IET Networks*, 8 (2019) pp. 256 - 263.
55. Sehgal, Ruchika; Mehra, Aparna, Enhanced indexing using weighted conditional value at risk. *Ann. Oper. Res.* 280 (2019), no. 1-2, 211–240.
56. Sahu, Abhilash; Priyadarshi, Amit, Semilinear elliptic equation involving the p-Laplacian on the Sierpiński gasket. *Complex Var. Elliptic Equ.* 64 (2019), no. 1, 112–125.
57. Sharma, R. K.; Gupta, Anju, Pair of primitive elements with prescribed traces over finite fields. *Comm. Algebra* 47 (2019), no. 3, 1278–1286.
58. Shukla, Ankita; Mehra, Mani, Fourth-order compact difference scheme for the backward heat conduction problem. *Int. J. Comput. Methods Eng. Sci. Mech.* 20 (2019), no. 5, 380–394.
59. Singh, Vikas Vikram; Lisser, Abdel, A second-order cone programming formulation for two player zero-sum games with chance constraints. *European J. Oper. Res.* 275 (2019), no. 3, 839–845.
60. Verma, S.; Viswanathan, P., A revisit to  $\alpha$ -fractal function and box dimension of its graph. *Fractals* 27 (2019), no. 6, 1950090, 15 pp.

### **Conference Proceedings**

61. Barequet, Gill; De, Minati, A lower bound on the growth constant of polyaboloes on the Tetrakis lattice. *Computing and combinatorics*, 13–24, *Lecture Notes in Comput. Sci.*, 11653, Springer, Cham, 2019.
62. Avrachenkov, Konstantin; Singh, Vikas Vikram, Stochastic coalitional better-response dynamics for finite games with application to network formation games. *Multilevel strategic interaction game models for complex networks*, 185–199, Springer, Cham, 2019.
63. Manisha; Rao, S. Chandra Sekhara, A computational technique for Asian option pricing model. *Computational science—ICCS 2019. Part III*, 326–339, *Lecture Notes in Comput. Sci.*, 11538, Springer, Cham, 2019.
64. Panda, B. S.; Chaudhary, Juhi, Dominating induced matching in some subclasses of bipartite graphs. *Algorithms and discrete applied mathematics*, 138–149, *Lecture Notes in Comput. Sci.*, 11394, Springer, Cham, 2019.
65. Rao, S. Chandra Sekhara; Srivastava, Varsha, Alternate overlapping Schwarz method for singularly perturbed semilinear convection-diffusion problems. *Numerical methods and applications*, 449–457, *Lecture Notes in Comput. Sci.*, 11189, Springer, Cham, 2019.
66. Rao, S. Chandra Sekhara; Chawla, Sheetal, The error analysis of finite difference approximation for a system of singularly perturbed semilinear reaction-diffusion equations with discontinuous source term. *Finite difference methods*, 175–184, *Lecture Notes in Comput. Sci.*, 11386, Springer, Cham, 2019.

## RECRUITMENT PROCEDURE

### JNF



Student-in-charge or placement officer, **Training and Placement Cell** shall provide the company a **Job Notification Form**.

JNF requires details of the job offer - role offered, pay package, place of posting, eligible documents.

Once the JNF with all the required details is received, companies are assigned username/password to access their online account at <http://tnp.iitd.ac.in>.

### COMPANIES



Companies are also assigned space on the server on which they may upload any presentation, videos, etc. which they want students to see.

## RECRUITMENT PROCEDURE

### COMPANIES



The JNF has to be frozen on the Training and Placement Cell website by the company by a fixed date.

Students shall be able to view all the details, all the eligible candidates may apply.

After the application deadline for the students, the resumes are visible to the company. The company submits shortlist on its online account before a deadline.

### SHORTLIST



Short-listed students get notified.

The placement office allots the dates for the campus interviews.

## RECRUITMENT PROCEDURE

### SELECTION



After the completion of the selection procedure on campus, company is required to announce **the final list** of the students on the same day itself.

*If a student is selected, the job is registered against him/her then s/he would not be allowed to appear for more interviews as per the institute's policy.*

### RESUME VERIFICATION



All **claims** made by students in the resumes submitted for campus placement are duly **verified by the Placement Office**.

## RECRUITMENT PROCEDURE



The **verification** standards are uniform throughout the Institute.

## OUR RECRUITERS

citigroup

P I M C O



**BOSCH**

**ORACLE**<sup>®</sup>

**IBM**

amazon

**AMERICAN EXPRESS**

GlobalLogic<sup>®</sup>

LEHMAN BROTHERS



Morgan  
Stanley

Microsoft<sup>®</sup>

Symantec.

**Google**

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# CONTACT US

Department Website: [maths.iitd.ac.in](http://maths.iitd.ac.in)

## INSTITUTE COORDINATORS

Prof. S. Dharmaraja

Head, Institute Career Service

[hodtnp@admin.iitd.ernet.in](mailto:hodtnp@admin.iitd.ernet.in)

Ms. Anishya Madan

Industrial Liaison Officer

[placement@admin.iitd.ac.in](mailto:placement@admin.iitd.ac.in)

## FACULTY COORDINATORS

Dr. Vikas Vikram Singh

Department Coordinator

[vikassingh@maths.iitd.ac.in](mailto:vikassingh@maths.iitd.ac.in)

Dr. Ritumoni Sarma

Department Coordinator

[ritumoni@maths.iitd.ac.in](mailto:ritumoni@maths.iitd.ac.in)

## TEAM MEMBERS

Silky Singh

6399360817

[mt1180769@maths.iitd.ac.in](mailto:mt1180769@maths.iitd.ac.in)

Aryan Gupta

9672577155

[mt1180745@maths.iitd.ac.in](mailto:mt1180745@maths.iitd.ac.in)

Arvish Dabra

9569407878

[mas197070@maths.iitd.a  
c.in](mailto:mas197070@maths.iitd.ac.in)



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## ADDRESS

**Office of Career Services**  
**3<sup>rd</sup> Floor, Synergy Building.**  
**Indian Institute of Technology, Delhi**  
**New Delhi - 110016**  
**Phone: [011-26591731/32](tel:011-26591731/32)**

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