

## Seewoo Lee

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### Education

<b>University of California Berkeley</b>	Berkeley
Ph.D in Mathematics	2018 – 2026 (expected)
– On leave for military service (2019 Fall - 2022 Summer)	
– Advisor: Sug Woo Shin	
<b>Pohang University of Science and Technology (POSTECH)</b>	Pohang
M.S in Mathematics	2017 – 2018
– Thesis: <i>Maass wave forms, quantum modular forms and Hecke operators</i>	
– Advisor: YoungJu Choie	
<b>Pohang University of Science and Technology (POSTECH)</b>	Pohang
B.S. in Mathematics	2013 – 2017
– <i>Summa Cum Laude</i> with top honours in mathematics	
– Honor's thesis: <i>Quantum modular forms and Hecke operators</i>	

### Experiences

<b>CryptoLab</b>	Seoul
Research Engineer	2021.05 – 2022.07
– Research on Homomorphic Encryption and application in Machine Learning	
<b>Riiid!</b>	Seoul
Research Scientist	2019.07 – 2021.05
– Research on Knowledge Tracing, Score Prediction, Student Dropout Prediction, Item Recommendation	

### Research Interests

- Automorphic Forms and Representations, Computational Number Theory, Relative Langlands Program
- Machine Learning and Deep Learning, Formalization of Mathematics, Homomorphic Encryption

## Publications

- Math

1. **S. Lee**, *Shanks bias in function fields*, To appear in Journal de Théorie des Nombres de Bordeaux, arXiv:2509.16142
2. J. Baek, **S. Lee**, *An equilateral triangle of side  $> n$  cannot be covered by  $n^2 + 1$  unit equilateral triangles homothetic to it*, American Mathematical Monthly, 1-9 (2024)
3. D. Choi, **S. Lee**, *Non-archimedean Sendov's conjecture*,  $p$ -adic numbers, Ultrametric Analysis and Applications 14, 77-80 (2022)
4. **S. Lee**, *Maass wave forms, Quantum Modular Forms and Hecke Operators*, Res. Mathematical Science 6, 7 (2018), Modular Forms are Everywhere: Celebration of Don Zagier's 65th Birthday
5. **S. Lee**, *Quantum Modular Forms and Hecke Operators*, Res. Number Theory 4, 18 (2018)
6. Y. Chen, R. Chernov, M. Flores, M. F. Bourque, **S. Lee**, B. Yang, *Toy Teichmüller spaces of real dimension 2: the pentagon and the punctured triangle*, Geom. Dedicata 197 (2018), 193-227

- Others

1. F. Lin, K. Nagel, **S. Lee**, J. Jiang, G. Yang, P. Chang, S. Li, N. Sheu, *An Analysis of Silk Density in Spider Webs*, Royal Society Open Science 12: 250455 (2025)
2. **S. Lee**, G. Lee, J. Kim, J. Shin, M. Lee, *HETAL: Efficient Privacy-preserving Transfer Learning with Homomorphic Encryption*, International Conference on Machine Learning. 2023 (Oral, 155/6538)
3. **S. Lee**, J. Kim, *Revisiting the Convergence Theorem for Competitive Bidding in Common Value Actions*, Economic Theory Bulletin 10, 293-302 (2022)
4. **S. Lee**, K. Kim, J. Shin, J. Park, *Tracing Knowledge for Tracing Dropouts: Multi-Task Training for Study Session Dropout Prediction*, Educational Data Mining. 2021
5. M. Kim, Y. Shim, **S. Lee**, H. Loh, J. Park, *Behavioral Testing of Deep Knowledge Tracing Models*, Educational Data Mining 2021
6. H. Loh, D. Shin, **S. Lee**, J. Baek, C. Hwang, Y. Lee, Y. Cha, S. Kwon, J. Park and Y. Choi, *Recommendation for Effective Standardized Exam Preparation*, LAK21: 11th International Learning Analytics and Knowledge Conference. 2021
7. D. Shin, Y. Shim, H. Yu, **S. Lee**, B. Kim, Y. Choi, *SAINT+: Integrating Temporal Features for EdNet Correctness Prediction*, LAK21: 11th International Learning Analytics and Knowledge Conference. 2021
8. Y. Choi, Y. Lee, D. Shin, J. Cho, S. Park, **S. Lee**, J. Baek, C. Bae, B. Kim, J. Heo, *EdNet: A Large-Scale Hierarchical Dataset in Education*, International Conference on Artificial Intelligence in Education (2021), 69-73
9. J. Kim, **S. Lee**, *Joint Liability and Stochastic Shapley Value*, International Review of Law & Economics 60 (2019), 1-8

## Preprints

1. G. Bates, R. Jesubalan, **S. Lee**, J. Lu, H. Shim, *Powerful Fibonacci polynomials over finite fields*, arXiv:2601.02664, submitted
2. J. Getz, A. G. Terradillos, F. Hosseiniyafari, B. Hu, **S. Lee**, A. Slipper, M.-H. Tomé, H. Yao, A. Zhao, *Modulation groups*, arXiv:2510.23932, submitted
3. K. Lee, **S. Lee**, *Machines Learn Number Fields, But How? The Case of Galois Groups*, arXiv:2508.06670, submitted
4. J. Baek, **S. Lee**, *Formalizing Mason–Stothers Theorem and its Corollaries in Lean 4*. arXiv:2408.15180
5. **S. Lee**, *Algebraic proof of modular form inequalities for optimal sphere packings*. arXiv:2406.14659, submitted
6. **S. Lee**, Y. Choi, J. Park, B. Kim, J. Shin, *Consistency and Monotonicity Regularization for Neural Knowledge Tracing*, arXiv:2105.00607
7. Y. Choi, Y. Lee, J. Cho, J. Baek, D. Shin, H. Yu, Y. Shim, **S. Lee**, J. Shin, C. Bae, B. Kim, J. Heo, *Assessment Modeling: Fundamental Pre-training Tasks for Interactive Educational Systems*, arXiv:2022.05505

## Awards, Grants & Honours

Department of Mathematics Summer Grant, UC Berkeley . . . . .	2024 Summer
Outstanding Graduate Student Instructor Award, UC Berkeley . . . . .	2024 Spring
Graduate Student Researcher, UC Berkeley . . . . .	2023 Spring, Summer
Kwanjeong Educational Foundation Scholarship, KEF . . . . .	2017–2018
Excellency Award (Top Honours), Dept. of Mathematics, POSTECH . . . . .	2017
POSTECH Outstanding Talent Development Scholarship, POSTECH . . . . .	2013–2016
National Science and Technology Scholarship, KOSAF . . . . .	2013–2016
Silver medals, Undergraduate Mathematical Competition, KMS . . . . .	2013, 2015, 2016
31st place, ACM-ICPC Daejeon Regional, ACM . . . . .	2015
Grand prize, POSTECH Programming Contest, Dept. of Computer Science, POSTECH . . . . .	2015
Honorable mention, Korean Olympiad of Informatics, NIA . . . . .	2012

## Teaching Experience

### Graduate Student Instructor (T.A.)

UC Berkeley

Berkeley  
2019 – Present

- (2025 Fall) Introduction to Abstract Algebra
- (2025 Spring) Cryptography
- (2025 Spring) Introduction to Mathematical Logic
- (2024 Fall) Abstract Linear Algebra
- (2024 Spring) Methods of Mathematics: Calculus, Statistics, and Combinatorics
- (2023 Fall) Methods of Mathematics: Calculus, Statistics, and Combinatorics
- (2022 Fall) Multivariable Calculus

- (2019 Spring) Methods of Mathematics: Calculus, Statistics, and Combinatorics

#### **Grader & T.A.**

POSTECH

Pohang  
2016 – 2018

- (2018 Spring) Differential Manifolds and Lie groups (Graduate course)
- (2017 Fall) Modern Algebra II
- (2017 Spring) Calculus
- (2016 Fall) Applied Linear Algebra (Undergraduate T.A.)

#### **Tutoring**

POSTECH

Pohang  
2014 – 2015

- (2015 Spring) Calculus
- (2015 Spring) Modern Algebra I
- (2014 Fall) Analysis II
- (2014 Spring) Analysis I

## **Outreach**

### **KIAS Winter School on Mathematics and AI**

Team Leader

Jeongseon  
2025 Winter

- Use machine learning to study Artin representations and abelian varieties over finite fields
- Team members: Dohoon Choi, Keunyoung Jeong, Jaehak Yi, Minseo Shin, Euntaek Lee, Taeyoung Kim

### **Berkeley Math REU**

Mentor

Berkeley  
2025 Summer

- Diophantine equations on Fibonacci polynomials and ties in Chebyshev bias over finite fields
- Mentees: Graeme Bates, Ryan Jesubalan, Jane Lu, Hyewon Shim

### **Directed Reading Program**

Mentor

Berkeley  
2023-present

- (2025 Fall) Group cohomology (Graeme Bates, Jane Lu)
- (2025 Spring, 2025 Fall) Modular forms (Dongho Kim)
- (2023 Fall) Elliptic curves (Jacob Martin)
- (2023 Spring)  $p$ -adic numbers (Lucas Xie)

### **POSTECH Potential Development Camp for High School Students**

Mentor

POSTECH  
2015 Winter

- Mentoring high school students for college-level mathematics

## **Talks**

- Research Talks

- Lean Together 2026, Online, January 2026  
Progress on the Sphere Packing Project (with Sidarth Hariharan and Chris Birkbeck)
- June E Huh Center for Mathematical Challenges, KIAS, Seoul, January 2026  
Positive Quasimodular forms and Linear Programming Bounds

- Number Theory Seminar, University of Wisconsin-Madison, Wisconsin, December 2025  
How Machines Learn Galois Groups
  - EPFL, Lausanne, November 2025  
Sphere Packing, Sign Uncertainty Principle, Universal Optimality, and Positive Quasimodular forms
  - Aarhus University, Aarhus, November 2025  
Sphere Packing, Sign Uncertainty Principle, Universal Optimality, and Positive Quasimodular forms
  - Special Seminar, Carnegie Mellon University, Pittsburgh, November 2025  
How Machines Learn Galois Groups
  - International Seminar on Automorphic Forms, Online, April 2025  
Algebraic proof of modular form inequalities for optimal sphere packings
  - RTG seminar, UC Berkeley, Berkeley, February 2025  
Algebraic proof of modular form inequalities for optimal sphere packings
  - Algebra Discrete Math seminar, UC Davis, Davis, January 2025  
Algebraic proof of modular form inequalities for optimal sphere packings
  - 6th EU/US Workshop on Automorphic Forms and Related Topics, Luminy, September 2024  
Algebraic proof of modular form inequalities for optimal sphere packings
  - POSTECH Number Theory Seminar, POSTECH, Pohang, May 2024  
Algebraic proof of modular form inequalities for optimal sphere packings
  - Student Number Theory Seminar, UC Berkeley, Berkeley, April 2024  
Algebraic proof of Viazovska's inequalities
  - School of Mathematics, KIAS, Seoul, December 2023  
A new proof of Viazovska's modular form inequality and beyond
  - International Conference on Machine Learning, Hawaii, US, July 2023  
HETAL: Efficient Privacy-preserving Transfer Learning with Homomorphic Encryption
  - Center for Artificial Intelligence and Natural Sciences, KIAS, Seoul, June 2023  
HETAL: Efficient Privacy-preserving Transfer Learning with Homomorphic Encryption
  - School of Computing, KAIST, Daejeon, June 2023  
HETAL: Efficient Privacy-preserving Transfer Learning with Homomorphic Encryption
  - 1st FHE.org workshop, Trondheim, May 2022  
Encrypted Multinomial Logistic Regression Training with Softmax Approximation
  - Workshop for Young Mathematicians in Korea, Online, January 2022  
Hitchhiker's guide to non-archimedean world
  - Graduate student seminar, Sogang University, Seoul, July 2018  
Maass wave forms, quantum modular forms and Hecke operators
  - Sungkyunkwan University, Seoul, June 2018  
Maass wave forms, quantum modular forms and Hecke operators
  - NCTS-POSTECH Number Theory Workshop, NTU, Taiwan, December 2017  
Quantum modular forms and Hecke operators
- Expository Talks
- Student Number Theory Seminar, Berkeley, August 2025  
How Do Automorphic Forms and Elliptic Curves Fly? (Survey on Murmuration)
  - Bruhat-Tits building seminar, Berkeley, February 2025  
Bruhat-Tits buildings for split groups / Moy-Prasad filtration and Local Langlands correspondence

- Berkeley–Stanford Number Theory Learning Seminar, Berkeley, December 2024.  
Proof of irrationality of  $L(2, \chi_{-3})$  and product of log values
- Student Number Theory Seminar, Berkeley, October 2024  
Modular forms on  $G_2$
- Geometric class field theory learning seminar, Berkeley, Sep 2024  
Singular algebraic curves and de-normalization
- Student Number Theory Seminar, Berkeley, March 2024  
Linear Programming Beyond Sphere Packing
- Orbit methods and automorphic forms learning seminar, Berkeley, Oct 2023  
Gan–Gross–Prasad conjectures
- Student Number Theory Seminar, Berkeley, Nov 2022  
Shimura correspondence and Waldspurger’s formula
- Instructional Workshop on Class Field Theory, KIAS, Seoul, January 2018  
Proof of the main theorem of local class field theory

## Languages

- Korean (native), English (fluent)
- Python (PyTorch, Numpy, Pandas), C/C++, L<sup>A</sup>T<sub>E</sub>X, SAGE Math, Lean, MATLAB, Haskell

## Miscellaneous (click the icons)

- Working as a reviewer for Mathematical Reviews (2022~) ↗
- GitHub blog on various topics ↗
- Math Stackexchange & Math Overflow ↗
- Speedcuber ↗
- DJ (Techno, Trance, House) ↗

(Last updated: January 21, 2026)