

## Seewoo Lee

Ph. D. student in Mathematics

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### Education

#### University of California Berkeley

Ph.D in Mathematics

Berkeley

2018 – Present

- On leave for military service (2019 Fall - 2022 Summer)
- Advisor: Sug Woo Shin

#### Pohang University of Science and Technology (POSTECH)

M.S in Mathematics

Pohang

2017 – 2018

- Thesis: *Maass wave forms, quantum modular forms and Hecke operators*
- Advisor: YoungJu Choie

#### Pohang University of Science and Technology (POSTECH)

B.S. in Mathematics

Pohang

2013 – 2017

- *Summa Cum Laude* with top honours in mathematics
- Honor's thesis: *Quantum modular forms and Hecke operators*

### Experiences

#### CryptoLab

Research Engineer

Seoul

2021.05 – 2022.07

- Research on Homomorphic Encryption and application in Machine Learning

#### Riidx!

Research Scientist

Seoul

2019.07 – 2021.05

- Research on Knowledge Tracing, Score Prediction, Student Dropout Prediction, Item Recommendation

### Research Interests

- Number theory, Automorphic Forms and Representations, Analytic Number Theory, Algebraic Number Theory, Relative Langlands Program
- Deep learning, Natural Language Processing, Homomorphic Encryption, Formalization of mathematics

## Publications

- Math

1. 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)
2. D. Choi, **S. Lee**, *Non-archimedean Sendov's conjecture*, *p*-adic numbers, Ultrametric Analysis and Applications 14, 77-80 (2022)
3. **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
4. **S. Lee**, *Quantum Modular Forms and Hecke Operators*, Res. Number Theory 4, 18 (2018)
5. 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. **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)
2. **S. Lee**, J. Kim, *Revisiting the Convergence Theorem for Competitive Bidding in Common Value Actions*, Economic Theory Bulletin 10, 293-302 (2022)
3. **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
4. M. Kim, Y. Shim, **S. Lee**, H. Loh, J. Park, *Behavioral Testing of Deep Knowledge Tracing Models*, Educational Data Mining 2021
5. 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
6. 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
7. Y. Choi, Y. Lee, D. Shin, J. Cho, S. Park, **S. Lee**, J. Baek, B. Kim, Y. Jang, *EdNet: A Large-Scale Hierarchical Dataset in Education*, International Conference on Artificial Intelligence in Education (2021), 69-73
8. J. Kim, **S. Lee**, *Joint Liability and Stochastic Shapley Value*, International Review of Law & Economics 60 (2019), 1-8

## Preprints

1. **S. Lee**, *Algebraic proof of modular form inequalities for optimal sphere packings*. arXiv:2406.14659
2. J. Baek, **S. Lee**, *Formalizing Mason–Stothers Theorem and its Corollaries in Lean 4*. arXiv:2408.15180

## 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

- (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

### Directed Reading Program

UC Berkeley

Berkeley  
2023

- (2023 Fall) Elliptic curves (Jacob Martin)
- (2023 Spring)  $p$ -adic numbers (Lucas Xie)

### Graduate Student Reader (Grader)

UC Berkeley

Berkeley  
2018

- (2018 Fall) Introduction to Abstract Algebra

### Grader & T.A.

POSTECH

Pohang  
2015 – 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.)
- (2015 Winter) POSTECH Potential Development Camp for High School Students

### Tutoring

POSTECH

Pohang  
2014 – 2015

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

## Talks

- Research Talks

- Algebra Discrete Math seminar, 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, Pohang, May 2024.  
Algebraic proof of modular form inequalities for optimal sphere packings
- Student Number Theory Seminar, 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, 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++,  $\text{\LaTeX}$ , 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) 