

Wei-Lin Wu

+886-958765824 | wwu53@ucsc.edu | Personal Website | LinkedIn | GitHub | Tainan, Taiwan

RESEARCH INTERESTS

Logic in Computer Science (with emphasis on Finite Model Theory), Algorithm Design, Graph Theory, Database Theory

COMPUTER LANGUAGES

C/C++, Python, Haskell, Agda, Dafny, Objective-C, Java, Scala, x86 Assembly, MIPS, L^AT_EX

EDUCATION

- **University of California, Santa Cruz**, Santa Cruz, CA 12/2023
 - Ph.D. in Computer Science (GPA: 3.96/4.00)
 - Dissertation: A Study of the Expressive Power of Homomorphism Counts
 - Relevant Courses: **Programming Languages and Verification (Dafny)**, **Logic in Computer Science**, Machine Learning, Advanced Algorithms, Data Science, Database Principles, Information Theory, Combinatorial Algorithms
 - Selected Projects:
 1. An **Interpreter for Register Machine** – a hypothetical computational model (imperative programming) – implemented in Haskell (declarative programming) to demonstrate the Turing-completeness of Haskell, GitHub: <https://github.com/JohnnieDM/CS203/tree/master/Final>
 2. A **Graph-Structure Analyzer** implemented in Python that computes a **logical characterization** of the k -dimensional Weisfeiler-Leman type of a graph equivalent to its vector representation encoded by the k -dimensional graph neural network (k -GNN), GitHub: <https://github.com/Linisac/Graph-Structure-Analyzer>
 3. A **Task Scheduler** implemented in C using a greedy-algorithm approach to schedule a finite set of tasks parameterized by deadlines and penalties to minimize total cost using a time-efficient implementation of the disjoint-set data structure, GitHub: <https://github.com/Linisac/Task-Scheduler/tree/main>
- **National Taiwan University**, Taipei, Taiwan 06/2009
 - M.S. in Computer Science and Information Engineering
 - Thesis: A Study on Expressing the Hamiltonian Path Problem in Second-Order Logic with Some Additional Predicate Symbols
 - Relevant Courses: Analysis of Algorithms, Biological Sequencing Algorithms, Bioinformatics, Algorithm Design, Financial Computing, Graph Algorithms, Computation Theory, Design of Databases
 - Selected Projects:
 1. A **Grid Indexing Structure** implemented in Java for H2 Database to improve performance with analysis reports of the impact of efficient indexing on database performance and comparisons to the built-in AVL tree indexing of H2 Database
 2. A **Finance Calculator** implemented in C++ to price barrier options using lattice model and to evaluate the risk-neutral value of derivatives with early exercise features (e.g., Bermudan or American style options) using least square Monte-Carlo and lattice model
- **National Cheng Kung University**, Tainan, Taiwan 06/2007
 - B.S. in Electrical Engineering
 - Relevant Courses: Linear Algebra, Probability and Statistics, Discrete and Combinatorial Mathematics, Data Structures, Algorithms, Digital Logic Design, Computer Architecture, x86 Assembly, Systems Programming, Operating Systems, Computer Networks, Taguchi Quality Engineering
 - Selected Projects:
 1. A **Simulator for a Simplified MIPS Architecture** implemented in C++ for a RISC computer architecture using the linked-list data structure for space efficiency with analysis reports of time efficiency
 2. A **Sudoku Solver** implemented in C using advanced backtracking techniques and efficient data structures

EXTRACURRICULAR PROJECTS

- **Annotations to “Mathematical Logic”** – a textbook by H.-D. Ebbinghaus, J. Flum, W. Thomas – with a complete solutions manual, GitHub: <https://github.com/Linisac/Mathematical-Logic-EFT->
- An **Interpreter for Random-Access Machine** – a hypothetical computational model introduced in the textbook “Computational Complexity” by Ch. H. Papadimitriou – implemented in C++ for illustration and demonstration, GitHub: <https://github.com/Linisac/RAM-Interpreter>

AWARDS

- **Regents’ Fellowship**, University of California, Santa Cruz 2017
- **Outstanding Achievement Award** for Physics Contest, National Cheng Kung University 2004
 - Top 0.5% among 1630 participants
- **Excellent Achievement Award** for Calculus Contest, National Cheng Kung University 2004
 - Top 2% among 2324 participants

PUBLICATIONS

Alphabetical authorship by the convention of theoretical computer science

- [ICDT] Balder ten Cate, Víctor Dalmau, Phokion G. Kolaitis, and **Wei-Lin Wu**: When Do Homomorphism Counts Help in Query Algorithms?. In *27th International Conference on Database Theory (ICDT 2024)*, LIPIcs, Volume 290, pages 8:1-8:20, Mar 25-28, 2024.
- [ICALP-affiliated Smp Workshop] **Wei-Lin Wu**: Query Algorithms Based on Homomorphism Counts. In *Structure Meets Power Workshop ICALP 2022 (Extended Abstract)*, pages 24-26, Jul 4-8, 2022.
- [LICS] Albert Atserias, Phokion G. Kolaitis, and **Wei-Lin Wu**: On the Expressive Power of Homomorphism Counts. In *36th Annual ACM/IEEE Symposium on Logic in Computer Science*, pages 1-13, Jun 29-Jul 2, 2021

TALKS & PRESENTATION

- [Invited Talk] A Study of the Expressive Power of Homomorphism Counts. In *Logic in Computer Science Special Session of the 2024 ASL Annual Meeting*, Iowa State University, Iowa, USA, 2024
- [Contributed Talk] Query Algorithms Based on Homomorphism Counts. In *Structure Meets Power Workshop ICALP 2022*, Paris, France (participated virtually via Zoom), 2022
- [Contributed Talk] On Capturing Some Equivalence Relations by Homomorphism Counts. In *Finite and Algorithmic Model Theory Seminar 22051*, Schloss Dagstuhl, Germany (invited participant), 2022
- [Presentation] On the Expressive Power of Homomorphism Counts. In *36th Annual ACM/IEEE Symposium on Logic in Computer Science*, Rome, Italy (participated virtually via Zoom), 2021

RESEARCH EXPERIENCE

- Research Assistant, **University of California, Santa Cruz**, Santa Cruz, CA 04/2020-06/2023
Advisor: Phokion G. Kolaitis
 - Formulated encoding techniques of common arithmetical operations within monadic second-order logic, investigated into the almost everywhere equivalence between its existential and universal fragments, and completed an elementary proof of definability of equality in first-order logic
 - Completed a detailed proof of a widely used formula concerning homomorphism counts, and investigated into the expressive power of homomorphism counts in terms of relaxations of graph isomorphism and of isomorphism-invariant property-testing algorithms
- Research Assistant, **Inst. of Information Science, Academia Sinica**, Taipei, Taiwan 10/2016-07/2017
Advisors: Shin-Cheng Mu & Tony Tan
 - Assisted research on formal methods of process calculi/session types and research on algorithmic problems and complexity of some fragments of first-order logic with counting
- Research Assistant, **Inst. of Information Science, Academia Sinica**, Taipei, Taiwan 11/2010-12/2011
Advisor: Shin-Cheng Mu
 - Derived formal proofs of set-theoretic theorems using theorem-proving languages Agda and Coq, and gave tutorials on functional programming (mainly Haskell and Agda) and on formalization of proofs in intuitionistic logic and foundational mathematics
- Student Researcher, **National Taiwan University**, Taipei, Taiwan 09/2007-06/2009
Advisor: Kun-Mao Chao
 - Investigated into mathematical logic and definability issues of graph-theoretic properties
- Student Researcher, **National Cheng Kung University**, Tainan, Taiwan 04/2004-08/2006
Advisor: Kuo-Yung Yen
 - Derived a new and simple proof of a property of π as defined via differential equations of sine and cosine functions, and led a study group of foundational mathematics and construction of number systems

TEACHING EXPERIENCE

- Teaching Assistant, **University of California, Santa Cruz** 09/2017-12/2022
 - Undergraduate computer science courses: Introduction to Programming in Java, Programming Abstractions with Python, Introduction to Analysis of Algorithms, Computational Models (8 terms), Comparative Programming Languages with Python, Scala, Haskell, Prolog
- Tutor, **Leadership Learning Center**, Tainan, Taiwan 02/2012-07/2015
 - Delivered lectures on high-school English and mathematics, compiled course materials and gave tutorials on fundamentals of computer science

INDUSTRY EXPERIENCE

- Software Engineer, **Fonestock Technology Inc.**, Taipei, Taiwan 05/2016-09/2016
 - Performed supportive work in maintenance, restructured source code (in Objective-C) of iOS apps for stock investments, improved app performance by implementing optimal sorting and searching algorithms, and resolved issues of app crashes and database inconsistency