

# Will Hardt

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## SUMMARY

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Ph.D. in Mathematics specializing in additive combinatorics with 4+ publications. Quantitative trading internship at Jane Street. Coursework in machine learning and deep learning. TA for graduate Math of Machine Learning. Completed data science bootcamp + a project using Python to predict patient copay at pharmacies.

## INDUSTRY EXPERIENCE

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**Jane Street Capital:** New York, NY May 2022 - August 2022  
*Quantitative Trading Intern*

- Built and analyzed linear regression models to predict investment grade bond yields using Python and SQL
- Discovered and quantified heteroskedasticity in models of commodity markets using Python and SQL

## SELECTED PROJECTS

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**Predicting Patient Copay at Pharmacies for [CoverMyMeds](#)** [[Github link](#)] Fall 2022

- Built several regression models on a large (13.9 million rows) simulated dataset of patient transactions
- Achieved an RMSE of \$15.60 using random forests compared to \$40.50 in the baseline model
- Collaborated with 2 other Ph.D. students and one postdoc as part of an [Erdős Institute bootcamp](#)

**Constructing Balanced Tensors (Ph.D. research on Smyth's Conjecture)** 2020-2023

- Researched and implemented algorithms to construct nonnegative tensors with certain algebraic symmetries
- Computationally verified cases of a stronger version of Smyth's Conjecture
- Proved [a function field analogue](#) of Smyth's Conjecture and a reduction of the original conjecture (forthcoming)

## PUBLICATIONS

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- Hardt, W. and Yin, J. *Linear Relations Among Galois Conjugates Over  $F_q(t)$*  (2022) [[Link](#)]
- Hardt, W. and Yin, J. *On an Algorithm Converging to Hyperstochastic Tensors* (2022) [[Link](#)]
- Gollakota, A., Hardt, W., and Miklós, I. *Packing Tree Degree Sequences* (2020) [[Link](#)]
- Gaetz, M., Hardt, W., and Sridhar, S. *Support Equalities Among Ribbon Schur Functions* (2019) [[Link](#)]

## SKILLS

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- **Languages & Platforms:** Python, SQL, LaTeX, Sage
- **Python Libraries:** NumPy, pandas, scikit-learn, matplotlib, seaborn
- **Machine Learning:** PyTorch, standard supervised and unsupervised learning algorithms
- **Quantitative:** calculus, probability, linear algebra, optimization, statistics

## TEACHING

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- TA for ~50 students in Mathematical Foundations of Machine Learning (graduate class) 2023
- TA for ~500 students in Calculus I, Calculus II, Discrete Math, and Linear Algebra over 8 semesters 2018-2022
- Instructor of Record for ~20 students in Preparatory Algebra 2020

## LEADERSHIP

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**Undergraduate Mentoring Program (UMP)** 2022-2023

- Advising 2-4 math undergraduates over 2 semesters on applying to grad school, internships, REUs, etc.

**Committee for TA Policies and Procedures (CTAPP)** 2021-2022

- Represented TAs in discussions of department policy
- Reviewed and provided feedback on ~30 TAs' evaluations

**Directed Reading Program (DRP)** 2019-2021

- Mentored 6 undergraduate math students over 4 semesters in advanced independent study

## EDUCATION

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**University of Wisconsin - Madison**, Ph.D. in Mathematics December 2023

Advisor: Jordan Ellenberg  
Research area: Additive combinatorics  
GPA: 3.90

**Carleton College**, B.A. in Mathematics, *magna cum laude* June 2018

Distinction for senior thesis on *Gröbner bases and Hilbert's Nullstellensatz*  
GPA: 3.83

**Budapest Semesters in Mathematics** Fall 2016

Achieved honors for receiving an A/A+ in 4+ classes