# jacobdenson

## Research Interests

Harmonic Analysis, Geometric Measure Theory, Additive Combinatorics

## Contact Information

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## Education

**2020-Present**
PhD in Mathematics at the University of Wisconsin, Madison.
**2017-2019**
Masters in Mathematics at the University of British Columbia (Thesis: Cartesian Products Avoiding Patterns).
**2013-2017**
Bachelors in Computing Science at the University of Alberta.

## Languages

English, Elementary Mandarin, Python, Perl, C++, C, C#, Matlab, HTML, Javascript, Latex

## Research Projects

2020-Now **Salem Sets Avoiding Patterns**
The goal of this project is to explore new tools which enable one to extend pattern avoidance methods in the Hausdorff dimension scheme to construct Salem sets avoiding patterns. I am currently preparing a paper on extending methods from rough pattern avoidance to the Salem setting.

2018-2019 **Large Sets Avoiding Rough Patterns**
*Collaboration with Dr. Malabika Pramanik and Dr. Joshua Zahl.* In this project, we hope to find subsets of Euclidean space with large fractal dimension avoiding particular point configurations, which might be described as having a 'rough' character, such as those related to additive structure on fractals.

2017 **Lagrangian Preserving Approximation for Vehicle Routing**
*Collaboration with Dr. Zachary Friggstad*. This project involves using the Lagrangian preserving approximation technique combined with a novel linear relaxation of variants of the vehicle routing problem to obtain state of the art approximation algorithms. Our work is detailed in notes linked here.

## Publications

Cartesian Products Avoiding Patterns (MSc Thesis)

Jacob Denson

*(Submitted Dec 2019)*

Large Sets Avoiding Rough Patterns

Jacob Denson, Malabika Pramanik, Joshua Zahl

Accepted for Publication in Springer Series Harmonic Analysis and Applications *(Submitted Apr 2019)*

Proofs in Three Bits or Less (Expository Article)

Jacob Denson

CMS Notes from the Margin *(Mar. 2018)*

## Awards

*2019*
February Fourier Talks Poster Presentation Award (2nd Place)
*2018*
NSERC CGSM
UBC Science Graduate Award (2nd Time)
*2017*
UBC Science Graduate Award
U of A Dean's Silver Medal in Science
NSERC USRA (2nd and 3rd Time)
*2016*
Jason Lang Scholarship (3rd Time)
*2015*
Jason Lang Scholarship (2nd Time)
*2014*
NSERC USRA
Jason Lang Scholarship
*2013*
U of A Academic Excellence Scholarship
U of A Science Academic Excellence Scholarship
Alexander Rutherford Achievement Scholarship

## Teaching Assistantships

*2019*
Multivariate Calculus
Graph Theory
*2018*
Introduction to Discrete Mathematics
Introduction to Probability
*2017*
Calculus for Forestry Students
Calculus for Business Students
*2015*
Tangible Introduction to Computer Science
Undergraduate TA

## Conference Presentations

2020-2021 **Salem Sets Avoiding Patterns**
*Presented at*:
- *The 2020 Ohio River Analysis Meeting*.
- *The University of Wisconsin Analysis Student Seminar*.

A talk discussing my work on constructing high dimensional Salem sets avoiding configurations. I emphasized the square root cancellation result necessary to extend previous results on Hausdorff dimension to constructing Salem sets, and the various concentration of measure results one can use to obtain this square root cancellation when using randomized constructions.

2018-2019 **Fractals Avoiding Fractal Sets**
*Presented at*:
- *The 2018 Mid-Atlantic Analysis Meeting*.
- *The 2018 CMS Winter Meeting*.
- *The 2019 Geometric and Harmonic Analysis (GAHA) Conference*.
- *Poster at the 2019 February Fourier Talks. Awarded Prize for 2nd Best Poster out of 19 participants*.
- *Poster at the 2019 Madison Lectures in Fourier Analysis*.

A talk discussing my work with Dr. Malabika Pramanik and Dr. Joshua Zahl on constructing high dimensional sets avoiding configurations. I emphasized the idea behind the discretization of a problem when working a single scale, as well as the phrasing of the discrete problem in terms of constructing independant sets in a hypergraph.

2016 **Molecular Gases and the Natural Numbers**
*Presented at the Canadian Undergraduate Mathematics Conference*. An expository talk introducing ergodic theory to undergraduate students, emphasizing its relation to a variety of problem in mathematics, especially number theory.

## Miscellaneous Talks

*Notes for my Talks can be found at my website: https://jdjake.github.io.*

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| 2019 | **Incidence Theorems over Field of Arbitrary Characteristic** | *Math 616A Class* |
| 2018 | **Hodge Theory: Harmonic Analysis in Topology** | *Math 529 Class* |
| 2018 | **Theta Functions** | *Math 600D Class* |
| 2018 | **Radon Transforms and Exceptional Projections** | *Math 542 Class* |
| 2017 | **Proofs in Three Bits or Less** | *UBC Graduate Seminar* |
| 2016 | **Why Physicists Care About the Fourier-Stieltjes Transform** | *Math 642 Class* |
| 2016 | **A Brief Respite in Abelian Harmonic Analysis** | *Math 642 Class* |
| 2016 | **Vector Fields, Hex, and Jordan Curves** | *Math 530 Class* |
| 2015 | **Category Theory for Programmers** | *University of Alberta Honors Seminar* |