

## Vita

Candidate's name: Evan Alexander MacTavish

Universities  
Attended: University of New Brunswick (2018)  
Bachelors of Computer Science

University of New Brunswick (2019)  
Bachelors of Science

University of New Brunswick (2023)  
Masters of Science

### Conferences:

Presentation: "The donut-shop model of Cops and Robbers" The Graph Searching in America (GRASAm) Workshop 2023, City University of New York (CUNY) Graduate Center, August 4, 2023.

Calculus Instruction in Atlantic Canada Meeting, June 21, 2023 (Virtual)

The East Coast Combinatorics Conference (ECCC) 2022, University of Prince Edward Island, Charlottetown, Prince Edward Island, August 17-18, 2022 (Virtual attendee)

The Graph Searching in Canada (GRASCan) Workshop 2022, Toronto Metropolitan University, August 4-5, 2022 (Virtual attendee)

The 2022 Canadian Mathematical Society (CMS) Summer Meeting, Memorial University, St. John's, Newfoundland, June 3-6, 2022

## The donut-shop model of cops and robbers

UNIVERSITY OF NEW BRUNSWICK

THESIS DEFENCE AND EXAMINATION

in Partial Fulfillment

of the Requirement for the Degree of  
Master of Science

by

**Evan A. MacTavish**

in the Department of Mathematics & Statistics

U.N.B., Fredericton, N.B.

**Wednesday, August 16<sup>th</sup>, 2023**

**2:30 p.m.**

Tilley Hall room 307 & MS TEAMS

Examining Committee

Dr. Andrea Burgess

Dr. Alyssa Sankey

Dr. David Bremner

Dr. Michael Fleming

Dr. Viqar Husain

Co-Supervisor

Co-Supervisor

Internal Examiner

External Examiner

Chair of Oral Examination

## Abstract

We explore a variation of the game of Cops and Robbers on graphs, in which cops pursue a robber in the presence of one or more special vertices: donut-shops. The location of the donut-shop is determined before each player selects their starting position, and should a cop ever move to a donut-shop, they cannot move for the remainder of the game. These conditions form the donut-shop model for Cops and Robbers. This thesis introduces the donut-shop cop-number, representing the minimum number of cops needed to capture the robber in this model. We determine the donut-shop cop-number of some classes of graphs, which depends on the vertex on which the donut-shop is established. In particular, we give an upper bound for the donut-shop cop-number of planar graphs. A

programmatic implementation of this model is also provided.