



**University
of Victoria**

Graduate Studies

Notice of the Final Oral Examination
for the Degree of Doctor of Philosophy

of

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MSc (University of Victoria, 2009)

BSc (University of Victoria, 2007)

“Thickly-Resolvable Designs”

Department of Mathematics and Statistics

Friday, July 29, 2016

9:30 A.M.

David Turpin Building

Room A144

Supervisory Committee:

Dr. Peter Dukes, Department of Mathematics and Statistics, University of Victoria (Supervisor)

Dr. Kieka Mynhardt, Department of Mathematics and Statistics, UVic (Member)

Dr. Frank Ruskey, Department of Computer Science, UVic (Outside Member)

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Dr. David Pike, Department of Mathematics and Statistics, Memorial University of Newfoundland

Chair of Oral Examination:

Dr. Justin Albert, Department of Physics and Astronomy, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

Abstract

In this dissertation, we consider a generalization of the historically significant problem posed in 1850 by Reverend Thomas Kirkman which asked whether it was possible for 15 schoolgirls to walk in lines of three to school for seven days so that no two of them appear in the same line on multiple days. This puzzle spawned the study of what we now call resolvable pairwise balanced designs, which balance pair coverage of points within blocks while also demanding that the blocks can be grouped in such a way that each group partitions the point-set. Our generalization aims to relax this condition slightly, so that each group of blocks balances point-wise coverage but each point occurs in each group σ times (instead of just once). We call these objects thickly-resolvable designs. Here we show that the necessary divisibility conditions for the existence of thickly-resolvable designs are also sufficient when the size of the point set is large enough. A few variations of this problem are considered as well.