University of Victoria | Graduate Studies

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

of

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"Limited Broadcast Domination"

Department of Mathematics and Statistics

Friday, December 20, 2019
10:00 A.M.
Clearihue Building
Room B007

Supervisory Committee:
Dr. Gary MacGillivray, Department of Mathematics and Statistics, UVic (Co-Supervisor)
Dr. M.A. Henning, Department of Mathematics and Statistics, UVic (Co-Supervisor)
Dr. Jing Huang, Department of Mathematics and Statistics, UVic (Member)
Dr. Kieka Mynhardt, Department of Mathematics and Statistics, UVic (Member)
Dr. Frank Ruskey, Department of Computer Science, UVic, (Outside Member)

External Examiner:
Dr. Ladislav Stacho, Department of Mathematics, Simon Fraser University

Chair of Oral Examination:
Dr. Perry Howard, Department of Biochemistry and Microbiology, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

Abstract

Let $G = (V, E)$ be a graph and f be a function such that $f : V \to \{0, 1, 2, \ldots k\}$. Let $V_f^+ = \{v : f(v) > 0\}$. If for every vertex $v \notin V_f^+$ there exists a vertex $w \in V_f^+$ such that $d(v, w) \leq f(w)$ then f is called a *k-limited dominating broadcast* of G. The quantity $\sum_{v \in V} f(v)$ is called the *cost* of the broadcast. The minimum cost of a dominating broadcast is called the *k-limited broadcast domination number* of G, and is denoted by $\gamma_{b,k}(G)$. This parameter $\gamma_{b,k}(G)$ is a variation of the well-studied broadcast domination number. The value $\gamma_{b,k}(G)$ can also be defined as a solution to an integer linear programming problem. The solution to the dual problem is defined as the k-limited multipacking number.

We begin with a survey of known results and background related to these broadcast domination related parameters. In Chapter 3, we give a proof of NP-completeness for the problem of determining the k-limited broadcast domination number for a fixed graph G, as well as a proof of NP-completeness for its dual problem of determining the k-limited multipacking number. Chapter 4 focuses on cubic and subcubic graphs. Here we give an upper bound for the 2-limited broadcast domination number of (C_4, C_6)-free cubic graphs. In Chapter 5, we describe algorithms which determine the *k*-limited broadcast domination number for strongly chordal graphs, interval graphs, circular arc graphs and proper interval bigraphs in polynomial time. In Chapter 6, we show that the *k*-limited broadcast domination number for trees can be determined in linear time. We also focus on trees and give a linear time algorithm which determines the 2-limited broadcast domination number of trees.