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# Binary Logistic Models with Partially Crossed Random Effects

UNIVERSITY OF NEW BRUNSWICK

THESIS DEFENCE AND EXAMINATION

in Partial Fulfillment

of the Requirement for the Degree of  
Master of Science

by

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in the Department of Mathematics & Statistics

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

**Thursday, October 28<sup>th</sup>, 2021**

**9:30 a.m.**

MS TEAMS

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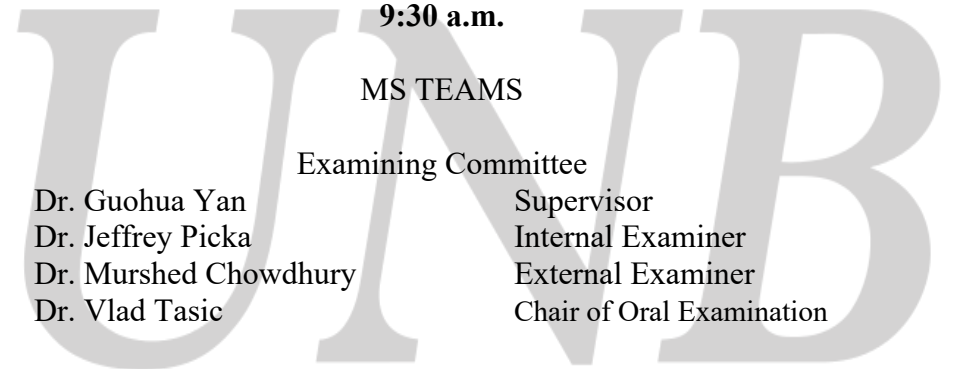
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## Abstract

Educational studies and behavioural scientists frequently encounter data with binary outcomes that have cross-classified data structures. For example, in a student admission study (success or failure), schools and areas could be treated as crossed random effects since not all students from the same school live in the same area and vice versa. It is crucial to incorporate crossed random effects into the model for data with cross-classified structures; otherwise, data analysis results could be misleading. This thesis proposes a binary logistic model with partially crossed random effects, which is further extended to a baseline-category logit model with partially crossed random effects for multinomial analysis. The random effects in our proposed models are predicted by the orthodox best linear unbiased predictors (BLUP) approach. Our models are robust because they only need to specify the

first and second moments of the random effects. The simulation study shows that the estimation algorithm generally performs well. In addition, we apply these models to insurance data about motor vehicle accidents and interpret the estimates for practical references.