# The Hong Kong University of Science and Technology

## Department of Mathematics

# PhD THESIS EXAMINATION

## *Predictive and Adaptive Group Testing Strategies*

*By*

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### ABSTRACT

Group testing is a strategy in statistics and combinatorial mathematics that divides the effort of recognizing specific objects into tests on groups of things rather than individual ones. Group testing has been applied to many fields to save the number of tests required. An age-old issue has attracted much attention due to the COVID-19 pandemic, which needs to test the infection status of individuals. The first part of this thesis will review the history of group testing and its primary classifications.

In the second and third parts, we propose a series of adaptive group testing methods, balancing efficiency gains and accuracy maintenance. The three-stage group testing procedures also avoid unnecessary operational delay as timeliness is essential in epidemic control. Furthermore, group testing can be more specific and predictive when considering more information about individuals. We consider the possible measure of risk and discuss methods when risk is available. An extensive simulation study guarantees the efficiency improvements in those methods.

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| **Date :** | **25 May 2022, Wednesday** | |
| **Time :** | **02:00 p.m.** | |
| **Venue :** | **Online via ZOOM** | |
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**The student's thesis is now being displayed on the reception counter in the General Administration Office (Room 3461).**