Incongruent Restricted Disjoint Covering Systems
Jacky Poon, Department of Statistics, Macquarie University

An incongruent restricted disjoint covering system (IRDCS) is a set of congruences {a1 mod m1, ... , ak mod mk}, mi > 2: i = 1,...,k, such that every integer in an interval [b,c] is satisfied by exactly one congruence and every congruence is satisfied at least twice. The concept is a new variant of covering systems developed very recently in late 2006.

Under the guidance of my supervisor, I learnt about the use of reviews of maths articles, and databases of reviews that was extremely helpful in streamlining the search for information. My main focus of research was on the related topic of covering systems, but I also briefly touched on the varied fields of Langford sequences, exact covers and NP-completeness. I searched for relevant ideas, and checked for whether the concept already existed in some other form.

There was also a practical component: I constructed programs in C++ to find examples of IRDCS for a given length through a variety of ways: naive brute force, using a more sophisticated backtrack algorithm developed by my supervisor, and also conversion to an exact cover problem which was then solved using the "Dancing Links" program by Dr. Donald Knuth of Stanford University.

The highlight of this scholarship was the Big Day In. It was interesting to meet other vacation scholars and scientists and see their unique and fascinating research, as well as present my findings.

I would like to thank my supervisor, Dr. Gerry Myerson, and Assoc. Prof. Jamie Simpson for allowing me this rare opportunity to look at a totally unexplored topic. The vacation scholarship were some of the most interesting six weeks I have ever had, and would be very informative to anyone who is considering pursuing postgraduate studies.